



# D!LEMMMA: DEBATE

MARCH 23-26

UTAH STATE UNIVERSITY

CELA 2016

CELA2016.COM

# DILEMMA : DEBATE CELA 2016

Department of Landscape Architecture and Environmental Planning  
College of Agriculture and Applied Sciences  
Utah State University

Published by  
Council of Educators in Landscape Architecture  
[www.thecela.org](http://www.thecela.org)

Editor  
Keith M Christensen  
Utah State University

Copyright © 2016 all rights reserved  
Printed in the United States of America

## Notice of Rights

All rights reserved. No part of this book may be reproduced or transmitted in any form or by any means, electronic, mechanical, photocopying, recording, or otherwise, without prior written permission from the Council of Educators in Landscape Architecture.

## Notice of Liability

The information in this book is distributed on an “as is” basis, without warranty. While every precaution has been taken in its preparation, neither the author nor the Council of Educators in Landscape Architecture shall have any liability to any person or entity with respect to any loss or damage caused or alleged to be caused directly or indirectly by any text contained in this book.

DILEMMA: DEBATE



CELA 2016

## CONFERENCE HOST

Department of Landscape Architecture and Environmental Planning  
College of Agriculture & Applied Sciences

Utah State University  
4005 Old Main Hill  
Logan, UT 84322-4005

## CONFERENCE COMMITTEE

**Sean Michael**, Committee Chair  
Professor / Dept. Head

**Ben George**  
Assistant Professor

**Keith Christensen**, Committee Co-chair  
Associate Professor

**Todd Johnson**  
Practitioner-in-residence /  
Associate Professor

**Bo Yang**, Committee Co-chair  
Associate Professor

**Caroline Lavoie**  
Associate Professor

**David Anderson**

Professional Practice Associate Professor

**Shujuan Li**  
Assistant Professor

**Mary Ann Anderson**  
Senior Staff Assistant

**Carlos Licon**  
Assistant Professor

**David Bell**

Extension Associate Professor

**Ole Sleipness**  
Assistant Professor

**David Evans**

Professional Practice Assistant Professor

**Phil Waite**  
Associate Professor

**Christina Fleener**  
Staff Assistant

**Barty Warren-Kretzschmar**  
Assistant Professor

## CONFERENCE ADMINISTRATION

**Kylie Downs**

Utah State University Conference Center

## CONFERENCE OVERVIEW

Conference sessions took place in the Salt Lake Marriott Downtown at City Creek. The Conference's Campus Day took place on the Utah State University main campus in Logan, home to the Department of Landscape Architecture & Environmental Planning, the 13th oldest program in North America.

CELA2016 is a green pledge conference, employing sustainable practices to limit direct and indirect impacts associated with the event. As the first CELA Conference to adopt this practice, CELA2016 heralds a new era, and establishes a baseline for future event planning, utilizing a sustainability framework to balance environmental, economic and social impacts.

## CELA LEADERSHIP

**Ming-Han Li**  
President

**Katya Crawford**  
President-elect

**Kenneth McCown**  
Past President

**Charlene LeBleu**  
Vice President for Research

**Hala Nassar**  
Second Vice President

**Judith Wasserman**  
Secretary

**Paul Voos**  
Treasurer

**Pat Tayler**, FCELA  
Interim Executive Director

**Dee Solco**  
Interim Business Manager

## CELA REGIONAL DIRECTORS

**Linda Ashby**, Region 1

**Lauri Johnson**, Region 2

**Jun-Hyun Kim**, Region 3

**Matthew Kirkwood**, Region 4

**Ryan Hargrove**, Region 5

**Chuo Li**, Region 6

**Elizabeth Brabec**, Region

**Linda Corkery**, Region 8

**Beth Faragan**, Student Director

## CELA TRACK CHAIRS 2015 – 2016

Communication & Visualization	Joni Palmer, University of Colorado at Boulder
Design Education & Pedagogy	Matthews Powers, Clemson University Ashley Steffens, University of Georgia
Design Implementation	Bo Yang, Utah State University
History, Theory & Culture	Judith Wasserman, University of Georgia Kelly Cook, University of Maryland
Landscape Performance	Patrick Mooney, University of British Columbia
Landscape Planning & Ecology	Galen Newman, Texas A&M University
People-Environment Relationships	Karen Wilson Baptist, University of Manitoba Deni Ruggeri, Norwegian University of Life Sciences
Research & Methods	Byoung-Suk Kweon, University of Maryland
Services Learning & Community Engagement	Malika Bose, Penn State University
Sustainability	Sohyun Park, Texas Tech University Mintai Kim, Virginia Polytechnic Institute
Urban Design	Madis Pihlak, Penn State University
Dilemma : Debate Film Track	Phoebe Likwar, Univeristy of Arkansas
Dilemma : Debate Theme Track	Shujuan Li, Utah State University



## ABSTRACT REVIEWERS

Adam Mekies	Caroline Lavoie	Heather Whitlow
Adnan Uzun	Caroline Westort	Helena Nordh
Aidan Ackerman	Caroline Westort	Herb Gottfried
Aidan Ackerman	Carter Crawford	Hwan Yong Kim
Alison Hirsch	Catherine Harris	Hyejung Chang
Alison Smith	Catherine Seavitt	Iain M Robertson
Allan Shearer	Nordenson	Isabel Fernandez
Amita Sinha	Cesar Torres Bustamante	Jack Sullivan
Andrea Galinski	Charels Klein	Jacqueline Margetts
Andreas Wesener	Charlene LeBleu	Jane Choi
Anita Bakshi	Cheryl Mihalko	Jason Walker
Anna Thurmayr	Chingwen Cheng	Jennifer Britton
Annaliese Bischoff	Christopher Ellis	Jennifer Britton
Anne Beamish	Christopher Marlow	Jeremy Merrill
Archana Sharma	Christopher Marlow	Jessica Canfield
Arianna Koudounas	Christopher Sass	Jie Xu
Art Rice	Chun-Yen Chang	Jocelyn Zanzot
Baldev Lamba	Chuo Li	Joe Ragsdale
Baldev Lamba	Claire Hempel	Joern Langhorst
Bambi Yost	Claudia Bernasconi	Jon Calabria
Barry Lehrman	Conor O'Shea	Jonathon Anderson
Barty Warren-Kretzschmar	Cynthia Girling	Joseph Ragsdale
Becky Heavner	Dan Chen	Josh Cerra
Benjamin George	Daniel Ortega	Judd Langham
Beverly Bass	Daryl Carrington	Judith Wasserman
Bin Jiang	David Barth	Judy Brittenum
Blake Belanger	David Hopman	Jun-Hyun Kim
Bo Yang	David Watts	Justin Scherma
Bo Zhang	Deni Ruggeri	Karen Landman
Bonj Szczygiel	Dietmar Straub	Karen Wilson Baptist
Brent Chamberlain	Dominic Fischer	Katherine Bennett
Brett Kordenbrock	Don Burger	Katherine Melcher
Brian Davis	Sarah Dooling	Katherine Melcher
Brian LaHaie	Ebru Ozer	Kathleen John-Alder
Bruce Dvorak	Elisabeth (Lisa) Orr	Kathleen Kambic
Bryce Lowery	Elizabeth Kirmmse	Kathy Kambic
Bulent Cengiz	Eric Bardenhagen	Katya Crawford
Byoung-Suk Kweon	Eric Castle	Keith Christensen
C.L. Bohannon	Erin Colwell	Kelly Curl
Canan Cengiz	Fernando Magallanes	Ken CcCown
Caren Yglesias	Frank Slegers	Ken Yocom
Carey Clouse	Gabriel Diaz Montemayor	Kenneth Brooks
Carl Smith	Galen Newman	Kim Douglas
Carla Corbin	Gary Austin	Kristian Kelley
Carlos Licon	Hala Nassar	Kristin Schwab

Lanbin Ren  
Lee Anne Milburn  
Leonard Yui  
Linda Ashby  
Linda Corkery  
Louis Mills  
M. Elen Deming  
Madis Pihlak  
Mallika Bose  
Maren King  
Margaret Livingston  
Mark Lindquist  
Martin Holland  
Mary Myers  
Mary Padua  
Matthew Gordy  
Matthew Traucht  
Melinda Appold  
Michael Seymour  
Mick Abbott  
Mike Barthelmeh  
Ming-Han Li  
Mira Engler  
N. Claire Napawan  
Nancy Vance  
Nathan Heavers  
Neil Challenger  
Noah Billig  
Ole Sleipness

Pat Crawford  
Patrick Mooney  
Peter Butler  
Peter Summerlin  
Phoebe Lickwar  
Rachel Berney  
Randy Hester  
Rebecca Heavner  
Rebecca O'Neal Dagg  
Rebecca Retzlaff  
Rebekah VanWieren  
Rebekah VanWieren  
Rennie Tang  
Richard Hawks  
Richard Hindle  
Rob Holmes  
Robert Brzuszek  
Robert Kuper  
Robert Ribe  
Ron Sawhill  
Roxi Thoren  
Ryan Hargrove  
Ryan Wright  
Sadik Artunc  
Sara Carr  
Sara Carr  
Sara Hadavi  
Sarah Dooling  
Sarah Thomas Karle

Scott Melbourne  
Scott Williams  
Sean Rotar  
Shabnam Kavousi  
Shawn Stankewich  
Shelby Doyle  
Simon Bussiere  
Simon Kilbane  
Sohyun Park  
Stevie Famulari  
Sung Ho Kil  
Susan Dieterlen  
Taner R. Ozdil  
Terry Clements  
Thomas Oles  
Tianqing Luo  
Tim Kane  
Tim Schauwecker  
Timothy Murtha  
Tom Woodfin  
Victoria Chanse  
Weimin Li  
Wendy McWilliam  
Will Green  
William "Chip" Winslow  
Yazan Mahadin  
Yazan Mahadin  
Yi Luo  
Zahra Zamani

## TABLE OF CONTENTS

CELA Conference Host	2
CELA Leadership	2
CELA Track Chairs	3
Abstract Reviewers	4

## COMMUNICATION AND VISUALIZATION

Mapping Changes in Tourist Routes as a Tool For Design: The Case of Berlin <i>Jane Fidman</i> .....	22
Publication Development as a Tool for Design Education <i>Isaac Gertman, Catherine Seavitt Nordenson</i> .....	23
Revitalizing alleys in high-density cities: How urban and landscape design interventions impact the sense of safety <i>Bin Jiang, Nga Sze Cecilia Mak</i> .....	24
Beyond Representation : Landscape rendering as a tool for data collection and design development <i>Ponnapa Prakkamakul</i> .....	25
Visualizing 200 Million Trees: a digital mapping narrative <i>David Karle</i> .....	26
Cycling-Friendly Community Designs: Comparative Case Studies of Cities in Germany and Texas, US <i>Sinan Zhong, Chanam Lee</i> .....	27
Just Use Your Imagination: Re Drawing and Re Making in the Rural Landscape Medium <i>Daniel Ortega</i> .....	28
Territorial Contexts: Persuasion and Mapping in Design <i>Justin Scherma Parscher</i> .....	29
Communicating Risk and Resiliency on Maryland's Eastern Shore: A Visual Preference Study <i>Elisabeth Walker, Victoria Chanse, Tory LaFemina</i> .....	30
Probing exhibitions' communicative potential: the interplay of the didactic and the evocative <i>Brenda J. Brown</i> .....	31
Drawing for Disclosure: constructing an understanding of hydraulic fracturing in the Susquehanna Watershed <i>Jamie Vanucchi</i> .....	32
LOOKDRAWTHINK : drawing as a research tool <i>Michael Sanchez</i> .....	33
Representing Resilience: Applications of Graphic Communication in Rebuild by Design <i>Blake Belanger</i> .....	34
#OurChangingClimate: A Digital Invitation <i>Nina Claire Napawan, Sheryl-Ann Simpson, Brett Snyder</i> .....	35
The Sketch Walk: Exploration, Discovery and Discussion of Place <i>Richard Alomar</i> .....	36
Landscape representation tools contextualize data, adding meaning and perspective for public evaluation <i>Sarah Schramm, Jacob Mitchell, Jeff Carney</i> .....	37
DAN KILEY LANDSCAPES IN BARTHOLOMEW COUNTY, INDIANA Materials from the Columbus Indiana Architectural Archives and Planting Typology Investigations of the Miller Garden and North Christian Church <i>Maria Debijs Counts, Ron Henderson</i> .....	38
Beyond the Map: Critical Cartography as Design Research <i>Tania Allen, Sara Queen</i> .....	39
Collecting the big idea: an exhibition of conceptual visualization in contemporary practice and education <i>Simon Bussiere, Quilian Riano, Dustin Headley</i> .....	40
Evaluating Urban Design Performance Using City Engine <i>Elizabeth Scot</i> .....	41
Visualizing restoration techniques to facilitate public understanding <i>Jacob Mitchell, Karen May</i> .....	42
On the Road Again... Perceiving and Drawing Large-scale Landscapes of the American West <i>Caroline Lavoie</i> .....	43
Landscape representation typology in ASLA student awards <i>Rebekah VanWieren</i> .....	44

The Trouble with Scale: Representing and understanding Louisiana's coast	<i>Karen May, Jacob Mitchell</i> .....	45
Digital design: Assessing the impacts of utilizing an advanced tablet as the sole mechanism for design	<i>David Evans, Benjamin George, Mark Jensen, Thomas Terry</i> .....	46
Testing Proxemics in The Elevator	<i>Bambi Yost</i> .....	47
Hidden History: Using digital tools to discover the historical landscape around us	<i>Amanda Hughes, Benjamin George, Ole Sleipness, Sriram Ramineni</i> .....	48
Coded Landscape: Programming Natural Phenomena	<i>Aidan Ackerman</i> .....	49
The Means of Physical Transference: The Experiential Path Toward Hybrid Graphics	<i>Kris Fox</i> .....	50

## DESIGN EDUCATION AND PEDAGOGY

The Creative Study Tour: a new approach to developing creative leaders in Landscape Architecture	<i>Ryan Hargrove</i> .....	52
The Perceived Effects of Flipped Teaching on Knowledge Acquisition	<i>Galen Newman, Jun-Hyun Kim</i> .....	53
Effectiveness of Using Digital Storytelling on Abroad Experiential Learning	<i>Tongbin Qu, Ming-Han Li, Ture Petersenn</i> .....	54
Drawn to Learn: Strategies for Visual Note Taking in Landscape Architecture Education	<i>Elizabeth Boult, Saboko Yui</i> .....	55
Rethinking the Five-year BLA; Alumni Reactions and Concerns	<i>Charles Klein, Johnathan Ulmer</i> .....	56
Landscape Architecture's Role in an Award-Winning Interdisciplinary Sustainability Program	<i>Joseph Ragsdale, Beverly Bass</i> .....	57
In Praise of Field Trips	<i>Joern Langhosh, Patricia McGirr, Hala Nassar, Joni Palmer, Karen Wilson Baptist</i> .....	58
Interpretive Landscape Design, Race, and Public [His]Story	<i>Holly Nelson, Laura Lawson, Anita Baksbi, David J. Goldstein</i> .....	59
Capstone Learning: Assessing Curricular and Professional Learning Outcomes	<i>David Watts, Cesar Torres Bustamante, Joseph Ragsdale</i> .....	60
The Effectiveness of Hands-on Design-Build Learning Opportunities in Landscape Design Studios	<i>Jun-Hyun Kim, Runzi Wang, Ming-Han Li</i> .....	61
A Macro Approach to Teaching Planting Design	<i>Susan Tomizawa, Ann Hildner</i> .....	62
Looking into the Future: Ten Year Review of Academic Job Openings in Landscape Architecture in US	<i>Taner R. Ozdil</i> .....	63
Pen and mouse: An evaluation of an on-line graphics course	<i>Benjamin George, Kris Kvarfordt, David Anderson</i> .....	64
Fieldwork: Definition, History, Ethics	<i>Phoebe Lickwar, Katya Crawford, Paula Horrigan, Thomas Oles</i> .....	65
Lawn and Order – Special Tree Victims Unit: A Seminar on Plant Establishment	<i>Julie Stevens, Jeff Iles</i> .....	66
Continuing to reduce human-nature distinction in landscape education, impacts and implications	<i>Tracy Walker, Moir-McClean</i> .....	67
Ensuring Successful Team Work in Education and Practice	<i>Sadik Artunc</i> .....	68



Exploring the Art and Science of Stream Restoration through Interdisciplinary Learning <i>Jessica Canfield, Tim Keane</i> .....	69
Assessing the Current Integration of Software in Landscape Architecture Curricula <i>Peter Summerlin, Benjamin George, Charles Taze Fulford</i> .....	70
The Boundary Management Tool Box: Key Strategies for Building the Expertise of Emerging Landscape Researchers and Practitioners to Address Complex, Socially-Rooted Environmental Problems <i>Laura Musacchio</i> .....	71
Feeling Small in Large Classes: Investigating How Small Group Blended Learning Strategy can Decrease Feelings of Anonymity and Perceived Class Size <i>David Spooner</i> .....	72
Inverted Tactics; A Negative Space Approach to Visualizing the Landscape <i>Maria Debije Counts, Christopher Counts</i> .....	73
Developing a Teaching Garden through Student Experiential Learning and Multidisciplinary Collaborative Scholarship <i>Michael Holmes</i> .....	74
A Faculty Finds Itself By Process <i>Todd Johnson, Barty Warren-Kretzschmar</i> .....	75
Feedback as a Teaching Tool: Aligning feedback with successive stages of the design process <i>Susan Tomizawa, Ann Hildner</i> .....	76
Landscape Architecture Education Curricula: What Can We Learn From Each Other? <i>Tanya Rice, Carlos Licon</i> .....	77
Mapping Curriculum Content Across a Landscape Architecture Program: Are We Teaching What We Think We Are Teaching? <i>Michael Holmes Cheryl Mihalko, Qing Lana Luo, Bo Zhang</i> .....	78
Design Week In Motion: Applying App Based Data Collection & Assessment in a Department-wide Studio Design Charrette <i>Christopher J. Seeger, Ryan Hargrove, Carolina Segura</i> .....	79
Assessing Learning Outcomes Using Cyclical, Scaffolded Student Reflections in Landscape Architecture Courses <i>Bambi Yost, Leila Tolderlund, Jon Hunt</i> .....	80
The Roadscape Project <i>Heidi Hohmann, Michael Martin</i> .....	81
The Role of Self-Regulated Learning in Design Pedagogy <i>Matthew Powers</i> .....	82
Design and education of Landscape Architecture's Curriculum in the University of Dammam <i>Ali Al-Sulbi</i> .....	83
Minecraft in Design Learning <i>Eric Castle</i> .....	84
An Instructional Module on Permaculture Design Theory for Landscape Architecture Students <i>Keni Althouse, Phil Waite</i> .....	85
Cross-Cultural Participatory Design Methods and Techniques across Differing International Political Contexts <i>Robert Hewitt, Hala Nassar</i> .....	86
Interdisciplinary Student Design Teams: Managing Turbulence, Building Momentum, and Fostering a Culture of Organizational Creativity <i>Eric Bardenhagen, Jeremy Merrill, Michael O'Brien</i> .....	87
Four Years Or Five Years? Discussions on the Recent Movement of Several Undergraduate Landscape Architecture Programs from Five to Four Years in the United States <i>Ming-Han Li, Brad Davis, Ned Crankshaw, Kim Douglas, Robert Hewitt, Kristopher Pritchard</i> .....	88
TopoGRAFT: Physical and Digital Modeling as Iterative, Reflexive, Generative <i>Valerie Friedmann</i> .....	89
Landscape Architecture and Allied Professions : Creating the Appropriate Multidisciplinary Teams in Higher Education <i>Robert Dalton, Pat Cranford, Christina DeJong</i> .....	90

## DESIGN IMPLEMENTATION

Design Assessment for Sustainable Hydrologic System Development using a Systematic Framework <i>Wonmin Sohn, Jun-Hyun Kim, Galen Newman</i> .....	92
Bioretention design parameters as predictors of pollutant removal efficiency—a data driven approach <i>Runzi Wang, Ming-Han Li</i> .....	93
Innovative Living Systems - growing green infrastructure in the semi-arid and arid West <i>Leila Tolderlund</i> .....	94
Ecological Patterns of Performance – Breathing Walls. <i>Leila Tolderlund</i> .....	95

## HISTORY AND THEORY

Elisaeus von Seutter’s “Ivy Cottage”: A Southern Victorian Garden in Photographs <i>Michael Seymour, Peter Summerlin</i> .....	97
Places of Intellectual Property <i>Richard Hindle</i> .....	98
An Infrastructure of Innovation: levees, patents, and the Department of Interior 1849-1925 <i>Richard Hindle</i> .....	99
Roberto Burle Marx in Brasília: The Ministries and the Military Dictatorship <i>Catherine Seavitt Nordenson</i> .....	100
Too Big to Fail: Mathematical Modeling and The Blue Dunes ReBuild by Design Proposal <i>Kathleen John-Alder</i> .....	101
BUILT WORKS AS MANIFESTATIONS OF DESIGN PHILOSOPHY: THE JOHN A. SIBLEY HORTICULTURAL CENTER AND THE CECIL B. DAY BUTTERFLY CENTER AT CALLAWAY GARDENS <i>Georgia Harrison</i> .....	102
Mosaic Modernity: the Public Park in 20th Century China <i>Mary Padua</i> .....	103
Before Brasília: Niemeyer, Kubitschek and the creation of the Pampulha Cultural Complex <i>Clark Taylor</i> .....	104
Roads, Rivers and Resources: Mapping Rome’s Building Materials Landscape. <i>Joseph Ragsdale</i> .....	105
"Records of a Dream": Agricultural Infrastructure and the Gardens of Middleton Place <i>Roxi Thoren</i> .....	106
Joe Deal’s photography of the American West and the notion of objectivity. <i>Anne Godfrey</i> .....	107
Rohwer Reconstructed: Interpreting Place through Experience <i>Kimball Erdman</i> .....	108
Cultural Landscapes and The National Map: Examining the U.S. Geological Survey’s Shifting Priorities in the Digital Age <i>Elisabeth Orr</i> .....	109
The Beginning of Landscape Architecture in Oklahoma <i>Bo Zhang, Cheryl Mibalko</i> .....	110
Temple Garden at Naumkeag: A Chinese Inspired Garden in the U.S. <i>Bo Zhang, Dan Chen</i> .....	111
Revealing integrated industrial narratives through digital reconstruction of a historic cultural landscape <i>Peter Butler, Charles Yuill</i> .....	112
What’s Happening Then: Living Museums and Living Landscape <i>Justin Scherma Parscher</i> .....	113
Wheatfield-A Confrontation- The Work of Agnes Denes <i>Kevin Benham</i> .....	114
Engineered Flow: A Sociotechnical Analysis of Austin’s Waller Creek Transformation <i>Jason Sowell</i> .....	115
The Lost Cause and Reunion in the Confederate Cemeteries of the North <i>Ned Crankshaw</i> .....	116
Coming to Terms with a Troubled Past: Charting the Spatial Legacies of Racial Segregation at a Land Grant University in South Carolina. <i>Martin Holland</i> .....	117
Eugenic Utopia: Health and Segregation in the Garden City <i>M. Elen Deming</i> .....	118

The Landscape Painter's Park: The Forest at Fontainebleau	<i>Chip Sullivan</i>	119
Weldon Gratton's Panoramic Overlook for Theodore Roosevelt National Park	<i>Matthew Kirkwood, Dominic Fischer</i>	120
From the PWA to Amy Poehler: The Rise of Recreation in Park Planning, 1930 to the present	<i>Heidi Hohmann</i>	121
Playfulness at Storm King	<i>Anne Godfrey</i>	122
Formed by Water: Case of a Desert City in Iran	<i>Nastaran Tebyanian, Maziar Memar, Ron Henderson</i>	123
"History Made Visual": Photography as a Lens for Richer Interpretations of Our Shifting Landscapes.	<i>Cynthia Mc Hone</i>	124
Of Muddy Waters and Presidential Memorials	<i>Paul Kelsch</i>	125
A Review of Crime Prevention Through Environmental Design Studies in China, 1985-2015	<i>Jingjing Wang, Sean Michael, Jianning Zhu</i>	126
Materiality of the American Modernists: how material experimentation helped shape a new style	<i>Timothy Baird</i>	127
Skateboard and Urban Park: Accommodation of Sports Activity and Its Spatial Development Phases in the Urban Parks of South Korea	<i>Soyoung Han, Mintai Kim</i>	128
Tiny chapels everywhere: The Imperios of the Azores	<i>Benjamin George, Ole Sleipness</i>	129
The Fayetteville Street Pedestrian Mall as a Dissolution of Public Space.	<i>Nicholas Serrano</i>	130
Vernacular Minimalism: a 21st century design approach	<i>Mary Padua</i>	131
Parsing the Complex Pastoral	<i>Meg Studer</i>	132

## LANDSCAPE PERFORMANCE

Integrating Life-Cycle Costs with Landscape Performance: Cost Comparison and Cost-Benefit Analysis	<i>Yi Luo, Ming-Han Li</i>	134
Measuring the Social Performance of Food Production Landscapes: Reflections on Establishing a Framework and Developing Associated Metrics	<i>Ellen Burke</i>	135
Seven years in the making: Insights to green roof performance that will advance widespread adoption in the U.S.	<i>Kevin Krogulecki, Erik Cronk, Joanne Westphal</i>	136
Desert Green Roof Performance: Opportunities and obstacles to mitigate stormwater flooding and urban heat islands in Arizona	<i>Paul Coseo</i>	137
Green infrastructure design for stormwater quality and climate change resilience: Monitoring and modeling study in a semiarid environment	<i>Bo Yang, Shujuan Li, Hailey Wall, Pamela Blackmore, Grant Hardy, John Locke</i>	138
Analyzing Long-Term Benefits of Stormwater Policies	<i>Cory Gallo, Stephanie Sigman</i>	139
The Social Preference for Landscape Performance: A Case study of 4 Chinese Urban Parks	<i>Yang Yang, Guangsi Lin, Honghong Zhao</i>	140
The Role of Landscape Performance in Standardized Landscape Architecture Curricula	<i>Arianna Koudounas, Andrew Fox, Emily McCoy, Kenneth Brooks, Stephanie Rolley</i>	141
Depicting Sustainability: Infographics Tell the Story of Daybreak's Landscape Performance	<i>Ekpanith Jom Naknakorn</i>	142
Evaluating Performance of Campus-based Agriculture: Is Bigger Better?	<i>David Douglas, Elen Deming</i>	143
A Strategic Response Study Featuring "Eco-upgrade" Concept: Rural Landscape Planning & Design in South Zhejiang, China	<i>Tiezheng Zhao, Yang Zhao</i>	144

Urban Stormwater and Vacancy: New takes on Green Infrastructure <i>Sean Burkholder</i> .....	145
Proposed Monitoring Plans for the Anticipated College of Architecture, Planning & Design Research Green Roof Systems <i>Lee Skabelund, Carol Blocksome, Mary Knapp</i> .....	146
Replicable Surveys and Generalizable Outcomes: Looking Beyond Case Studies in Social Performance Research <i>Mary Myers, Taner Ozdil, Elen Deming, Heather Whitlow</i> .....	147
Landscape Performance Case Study Meta-analysis: a step toward informing design <i>Mary Myers, Bo Yang</i> .....	148
The use and abuse of ecological concepts in landscape architecture <i>Stephanie Carlisle, Nicholas Pevzner</i> .....	149
US Coast Guard Headquarters Heat Island Performance <i>Christopher D. Ellis, C. Dylan Reilly</i> .....	150
Biodiversity at the U.S. Coast Guard Headquarters: Analyzing Quantitative Measures of Performance <i>Charles Reilly, Christopher Ellis</i> .....	151
The Benefits of Unmanned Aerial Vehicles (UAVs) for Analyzing Land-Cover Temperature <i>Sung-Ho Kil, Jun-Hyun Kim, Galen Newman, Dong-Kun Lee, Jong-Hoon Park</i> .....	152
Landscape Architecture, Landscape Performance and STEM Education . <i>Byoung-Suk Kweon, Christopher D. Ellis</i> .....	153
Reading the Cultural Specificities of the Iraqi Marsh Arabs from their Landscape <i>Rasha Al- Tameemi</i> .....	154
Landscape Performance in a Rural State: A Bold Idea in a Change Averse Town <i>Matthew James, Erika Roeber</i> .....	155
Understanding Courtyards at US Coast Headquarters: A Methodology to Quantify Use and Density <i>Charles Reilly, Christopher Ellis</i> .....	156

## LANDSCAPE PLANNING AND ECOLOGY

Journeys in the Cultural Landscapes of Okhamandal in Gujarat, India: An Ecological Model for Heritage Conservation <i>Heena Gajjar, Amita Sinha</i> .....	158
The Miasmist: George E. Waring, Jr. and the Evolution of Modern Public Health <i>Catherine Seavitt Nordenson</i> .....	159
Evaluating CWWP effectiveness: Wildland fire and defensible space <i>Travis Flohr</i> .....	160
'Incomplete' Green Infrastructure: Lessons Learned from Rapid Urbanization in Beijing China <i>Huaqing Wang, Ming-Han Li</i> .....	161
Air temperature Differences between Green Spaces and Non-Green Spaces on Highly Developed Urban Area in Summer <i>Jong-Hoon Park, Dong-Kun Lee, Jun-Hyun Kim</i> .....	162
The Adaptive Reuse of Urban Brownfields: Dilemmas of Urgency and Process <i>Wolfram Hoefer, Zenon Tech-Czarny</i> .....	163
Evaluating Rural Landscape Design Decision Making Using Collaborative Geodesign Technology and Scaffolded Social Learning <i>David Pitt, Bryan Runck, Madeline Goldkamp, Carissa Schively Slotterback, Jonathan Fillmore, Cindy Zerger, Len Kne, Nicholas Jordan, David Mulla, Michael Reichenbach, Alexander Heid</i> .....	164
Forgotten Ecosystem Services: Conflicting Values between Storm Water Management and Ecological Integrity in Urban Playa Lakes <i>Sohyun Park, Jared Horsford</i> .....	165
Community development through participatory action research: A case study of Wyoming County, WV <i>Peter Butler, Kudzayi Maumbe</i> .....	166
Differences in nutrient and metal uptake among plant species in stormwater bioretention systems <i>Malgorzata Rycenicz-Borecki, R. Ryan Dupont, Joan E. McLean</i> .....	167



Using InVEST to Evaluate the Performance of Urban Growth Management Strategies in Conserving Ecosystem Services in the Urban Fringe Areas of the City of Corvallis, OR.	
<i>Long Zhou</i> .....	168
Marginal Utility: Roadside Vegetation in The Mobile Bay Drainage Area <i>Valerie Friedmann, Molly Hendry</i> .....	169
Acoustic ecology and the Tzintzuntzan hummingbird habitat restoration <i>Brenda J. Brown</i> .....	170
An ecological greenway studio planning and design process for riparian landscapes in California <i>Steven Greco</i> .....	171
Specifying prescribed fire for habitat, restoration, and regeneration: Leadership demonstrated in the Southeastern US <i>Vaike Haas</i> .....	172
Wet Studies in a Dry State <i>Tim Keane</i> .....	173
Using phenomenology to increase biological identity and the sensory experience <i>Gabriela Arevalo, Charlene Lebleu</i> .....	174
Alternative Futures for the Rural Intermountain West: Case study of the San Rafael River Basin in southern Utah <i>Barty Warren-Kretzschmar, Richard Toth, Carly Klein, Stephanie Tomlin</i> .....	175
Integrating water and land use planning for wildlife habitat conservation <i>Shujuan Li, Bo Yang, Joanna Endter-Wada, Enjie Li</i> .....	176
Four Coasts: Exploring the Regional Contentions of Dredging and Sediment Management <i>Sean Burkholder, Brian Davis, Gale Fulton, Rob Holmes, Brett Milligan</i> .....	177
Landscape Changes in the Mekong River Basin: Effects of Multiple HydroElectric Dams on the River Channel, Delta, and Fishery <i>G. Mathias Kondolf, Alexander Rubin</i> .....	178
Assessing habitat suitability of Günther's frog ( <i>Hylarana guentheri</i> ) in an agricultural landscape <i>Chen-Fa Wu, Szu-Hung Chen, Shin-Ruoh Juang</i> .....	179
Urban Riverside Ecology and Biodiversity <i>ChiaChing Wu, ChunYen Chang</i> .....	180
Marshes, Muck, and a Monoculture: the dilemma of <i>Phragmites australis</i> in the Saginaw Bay <i>Karen Lutsky</i> .....	181
Agri-Coastal: Reimagining Nutrient Dynamics in the Mississippi River Delta <i>Forbes Lipschitz</i> .....	182
Advancing Coastal Marine Planning <i>Charlene LeBleu, Rebecca Retzlaff, Joshua Cameron</i> .....	183
Geomorphic Effects of Urbanization on Inner-Bluegrass Streams <i>Christopher Sass, Morgan Dunay, Michelle Humerkoch</i> .....	184
A strategy for locating constructed wetlands as part of a watershed management plan <i>Miran Day, David Kovacic</i> .....	185

## PEOPLE-ENVIRONMENT RELATIONSHIPS

“Psychological park accessibility”: A literature review of perceptual components affecting park use <i>Keunhyun Park</i> .....	187
Creating Outdoor Play Environments which Support the Social Interactions of Children with Autism Spectrum Disorder <i>Keith Christensen, Laura Patricia Reyes Romero</i> .....	188
The Edible Academy: Learning from the Rome Sustainable Food Project <i>Carey Clouse</i> .....	189
The Geography of Civil Unrest: Designing the Public Realm in the Insurgent Spaces of the City <i>Alison Hirsch</i> .....	190
The impact of green infrastructure on human health and well-being: A comparison of the Greenway and Urban Park in Blacksburg, Virginia <i>Gunwoo Kim, Patrick Miller</i> .....	191

Recreation Impacts of Disadvantaged Los Angeles Residents on Picnic Areas and River Corridors: Examining Sources of Trash and Water Quality Impacts at Cattle Canyon <i>Lee-Anne Milburn, Patricia Winter</i> .....	192
Consuming Wilderness: Our Relationship to the Modern Western Landscape <i>Bradford Watson</i> .....	193
Waste Space or Essential Space? A Report of Systematic Literature Review on Hospital Corridor Design <i>Shan Jiang</i> .....	194
Urban Soundscapes: The Interactive Effect of Auditory and Visual Stimulations on Mood <i>Bin Jiang, Wenqi Ji, Matthew Pryor, Tian Zhang, William C. Sullivan</i> .....	195
Incorporating Natural Landforms to Enhance Children's Play Engagement <i>David Watts</i> .....	196
Urban natural environments, obesity, and health-related quality of life among Hispanic children living in inner-city neighborhoods <i>Jun-Hyun Kim, Chanam Lee, Wonmin Sohn</i> .....	197
EMPIRICAL AND EXPERIENTIAL: Implementing Measure in the Observation of Environmental Phenomena <i>Suzanne Mathew</i> .....	198
THE DILEMMA OF THE EDGE: EXPANDING OUR LANGUAGE FOR COASTAL INTERVENTION <i>Nancy Vance, Jacky Bowring, Mick Abbott</i> .....	199
The effects of participation of community gardening on the development of Sense of Community <i>Kyunghee Kim, Yoonku Kwon, Mintai Kim, Cermetrius Bohannon</i> .....	200
The psychological effect of Forest School Program on elementary school students <i>Bum-Jin Park, Seon A Kim</i> .....	201
Children's Perceptions of their Neighborhood's Walking Environment <i>Chuo Li, Michael Seymour</i> .....	202
Failed Meadow Installations in the Southeast: Lessons Learned, Theory for Future Success <i>Brad Davis</i> .....	203
Creating Right Greenway in the High-Density Inner City to Promote Residents' Mental Health and Wellbeing: Evidence from a Mega-city in China <i>Weiting Shan, Bin Jiang</i> .....	204
Healthy Landscapes & Human Health <i>William Sullivan, Chun-Yen Chang, Bin Jiang, Dongying Li</i> .....	205
Integrating Agriculture: Case Studies in Contemporary Practice. <i>Phoebe Lickwar</i> .....	206
Employing Prison Garden Design and Implementation to Enhance Well Being for Incarcerated Women <i>Julie Stevens</i> .....	207
A Collaborative Heritage Preservation Process for Oil Field Communities <i>Dominic Fischer, Heather Fischer</i> .....	208
An exploration of the use of social media for public participation in ecological planning and design process <i>Megan Pilla, Frank Gallagher</i> .....	209
How Much Vegetation Density in Green Infrastructure Do People Prefer? <i>Pongsakorn Suppakittpaisarn, Bin Jiang, William Sullivan</i> .....	210
Existing built environment elements in outdoor preschool settings and young children's moderate and fast physical activity levels <i>Zabra Zamani</i> .....	211
Gender differences and physical activity levels: What physical elements in outdoor preschools enhance physical activity levels in female children? <i>Zabra Zamani</i> .....	212
Different Perspectives on Landscape as a Resource: the Case of the Italian Alpine Region of Trento <i>Stefania Staniscia, Cristina Mattiucci</i> .....	213
Exploring the relationship between urban trees and residential density within a museum-based urban ecology exhibit <i>Jane Buxton, Robert Ryan</i> .....	214
PERCEPTIONS OF VIDEO WITH ACCOUSTIC SIMULATIONS OF POTENTIAL WIND ENERGY PARKS IN SWITZERLAND: SCENIC VERSUS ACCEPTABILITY JUDGEMENTS, INFORMATION EFFECTS AND ATTITUDES <i>Robert Ribe, Madeleine Manyoky, Ulrike Wissen Hayek, Adrienne Gret-Regamey</i> .....	215

Multidimensionality of neighborhood satisfaction and use patterns and their associations in urban residential areas <i>Sara Hadavi</i> .....	216
Impact of Exposure to Green Spaces and Laptop Use on Students' Cognitive Functioning <i>Rose Schmitten, Bin Jiang, William Sullivan</i> .....	217
Territories of Extraction: energy, settlement, hydrology, habitat <i>Nicholas Pevzner</i> .....	218
Urban Park Design in Iran: Investigation of Factors affecting Users' psychological benefits <i>Mehran Rayatidamavandi, Isabel Fernandez</i> .....	219
The Influences of Waterscape Types and Scales on Medical Staffs' Psychophysiological Responses <i>Man-Li Liao, Wan-Jou Yeh, Sheng-Jung Ou, Tsuo-Hung Lan, William Sullivan, Chun-Yen Chang</i> .....	220
Using Google Street View to Examine High School Students' Exposure to Green Space and Their Psychological Well-being <i>Dongying Li, Marcus Slavenas, William C. Sullivan</i> .....	221
Finding informality in urban agriculture: From mapping to supporting food equity <i>David de la Peña</i> .....	222
Attention Restoration Benefits of integrating green space in indoor environments <i>Jiajing Chen, William Sullivan, Carol Emmerling-DiNovo</i> .....	223
Water-based spatial anchor as the sixth element of imageability, <i>Hope Rising</i> .....	224
School Environments and links to Student's School Performance <i>Byoung-Suk Kweon, Christopher D. Ellis, Jung A Lee, Kimberly Jacobs</i> .....	225
A Design Framework for Active Aging-Focused Parks <i>Eric Bardenhagen, Grant Donald</i> .....	226
Environmental and Personal Correlates of Walking to Park: Exploring distance threshold effects <i>Chanam Lee, Young-Jae Kim, Chunkuen Lee, Minjie Xu</i> .....	227
Assessing design principles of urban parks for the purpose of promoting women's satisfaction <i>Mehran Rayatidamavandi</i> .....	228
"We are the People Living Under Fangyan Mountain!" - Cultural Landscape and Collective Identity of Yanxia, Zhejiang Province, China" <i>WEI ZHAO</i> .....	229
Healthcare Reform and the Entrepreneurial City <i>Laura Marie Barrett</i> .....	230
Recreational Community Branding: A Comparative Analysis within Utah's Wasatch Front <i>Lynda Draper Smith, Ole Sleipness, David Evans</i> .....	231
Garden Luminosity <i>Molly Hendry, Charlene LeBleu</i> .....	232
Using Virtual Reality Techniques to Evaluate Urban Architectural Factors in Relation to Human Stress Levels <i>Saleh Kalantari, Ebrahim Poustinchi</i> .....	233

## RESEARCH METHODS

An fMRI analysis of the graphic design thinking and creativity <i>Chun-Yen Chang, Yu-Ping Tasi, William Sullivan</i> .....	235
Designing a Neighborhood to Prevent Crime and Increase Physical Activity: A Case Study Among African-American Women in Kansas City, Missouri <i>Cydney Jones, Hyung Jin Kim</i> .....	236
Testing the reliability of sketch maps for multi-sited design studies <i>Hope Rising</i> .....	237
Phenomenological Perspectives as Frameworks for Interdisciplinary Studies of Historic Landscapes Integrating Landscape Architecture, Public History, and Landscape Archeology <i>Charles Yuill, Peter Butler</i> .....	238
A Mixed Grass Prairie, and Cross Timbers Aesthetic; Principles, Elements, and Materials Defined <i>Cheryl Mihalko</i> .....	239

Scripting in Landscape Assessment: A Vegetation Density Case Study <i>Pongsakorn Suppakittpaisarn, Marcus Slavenas, Bin Jiang, William Sullivan</i> .....	240
Reasonable Doubt: Design Experiments for Living with Water in São Paulo <i>Brian Davis</i> .....	241
Landscape Visualization in Gaming Environments <i>Brent Chamberlain, Howard Hahn, Natalie Webb, Kraig Weber, Ryan Albracht</i> .....	242
Green Infrastructure Impacts on Attention Restoration Measured by Functional Magnetic Resonance Imaging (fMRI) <i>William Sullivan, Xiangrong Jiang, Fatemeh Saeidi-Rizi</i> .....	243
MAKING TERRAIN: DRONES, PHOTOGRAMMETRY and TRANSLATIONS of SEDIMENT <i>Brett Milligan</i> .....	244
Synthetic Cartography as Landscape Architectural Research <i>Rob Holmes</i> .....	245
Identifying the necessity and gaps in data for developing countries to model sea level rise's impact: a case study of Pearl River Delta, China <i>Yang Ju</i> .....	246
Developing a Park Quality Index (PQI) as a Tool for Measuring the Impact of Urban Parks on Residential Property Values <i>Bungyu Choi, Chanam Lee</i> .....	247
Do You Eat Your Greens? <i>Jeremy Merrill, Bruce Dvorak, Randy Breeding</i> .....	248

## SERVICE-LEARNING AND COMMUNITY ENGAGEMENT

Geodesign as an educational tool <i>Barty Warren-Kretzschmar, Carlos Licon</i> .....	250
The Structure of Engaging Communities: Structural diversity of design outreach and service <i>Jayoung Koo</i> .....	251
Pro-Active Recovery Community Structures (PARCS) <i>Andrew Fox, David Hill</i> .....	252
Life Cycle of a Rain Garden Service-Learning Project <i>Jennifer Britton</i> .....	253
Student Reflections of Community Engagement in Design Education: Exploration of Social Responsibility and Professional Development <i>C.L. Bohannon, Terry Clements</i> .....	254
Together We Design 2: Critical Reflections on Techniques for Transactive Design <i>CL Bohannon, Victoria Chanse, Terry Clements, Julie Johnson</i> .....	255
A Unique Combination of Teaching and Extension Appointments for Faculty: Bridging Community Service and Academic Learning <i>Qing Luo</i> .....	256
In-situ Community Design- Transdisciplinary Storefront as Performative Space <i>Ashley Kyber, Charles Yuill, Peter Butler</i> .....	257
DIY Cartography: Using Creative Placemaking and Historical Perspective to Engage Citizens in Discourse on Community, Culture and Urban Development <i>Sara Queen, Tania Allen</i> .....	258
Give and Take: A Social and Material Systems Approach to the Open Community Garden <i>Tobiah Horton</i> .....	259
Turning to a Landscape of Citizenship: the critical effects of introducing landscape architecture to the Cleveland Urban Design Collaborative <i>William Willoughby, Charles Frederick</i> .....	260
Rural Interdisciplinary Service-Learning Projects: Frameworks for Engagement within Regional Rural Development Centers <i>Ole Sleipness, Kathleen Ryan, Robert Krikac, Susie Gomez</i> .....	261
The Community Design Team: Pedagogy of Practice and Community Service <i>David Evans, David Anderson</i> .....	262



## SUSTAINABILITY

Understanding Transit Ridership: Using regression analysis to generate ridership forecasts for better performance measurement of transit agencies. <i>Torrey Lyons</i> .....	264
A Comparison of Design Processes Between Sustainable SITES™ - Certified and Non-Certified Urban Open Space Projects <i>Jennifer Wiseman, Ole Sleipness, David Evans</i> .....	265
Reclaiming greens in the Southwest: Strategies for transforming golf courses into multiuse desert communities <i>Kelly Cederberg, Margaret Livingston</i> .....	266
Designing for Modular Composting at the Community Scale <i>Andrew Schlesinger, Richard Alomar</i> .....	267
Into the meadow and rain-garden: A discussion of plans for and the broader implications of on-campus green infrastructure research, teaching, and outreach. <i>Lee Skabelund, Katie Kingery-Page, Jessica Canfield, Stacy Hutchinson</i> .....	268
Green Roof or Solar Panels? <i>Kirk Dimond</i> .....	269
Investigating Climate Justice in Green Infrastructure Planning: A case for the Huron River watershed, Michigan <i>Chingwen Cheng</i> .....	270

## URBAN DESIGN

Safe urbanism: role of design retrofits, design thinking and design culture in reducing accidents <i>Archana Sharma</i> .....	272
The Role of the Creative Class in Small Town Regeneration: A Case Study of Kinston, NC <i>Beverly Bass</i> .....	273
A Current Inventory of Vacant Urban Land in America <i>Galen Newman, Ann Bowman, Ryun Jung Lee</i> .....	274
CONSIDERING COMPACT DEVELOPMENT: PREFERENCES IN NORTHWEST ARKANSAS WITH REGARD TO TRADING OFF PRIVATE SPATIAL AMENITY WITH COMMUNITY BENEFITS <i>Carl Smith, Noah Billig</i> .....	275
The Tremendous and Troubling Success of New York City's High Line Park <i>Clark Taylor</i> .....	276
#OpenCity: Social Networks for Participatory Urban Design <i>Nina Claire Napawan, Brett Snyder, Sheryl-Ann Simpson</i> .....	277
Landscape Urbanism: An Exploration in Connecting the (Dis-connected) Green to the (Fragmented) City <i>Ming-Chun Lee</i> .....	278
Security in Future Urban Environments <i>Allan Shearer</i> .....	279
Suburban Terracing: experiments in topographically responsive urban design <i>Karl Kullmann</i> .....	280
Seven Decades On: landscape urban strategies for downtown Nagasaki <i>Karl Kullmann, Kushal Lachhwani, Anna Thompson, Michelle Hook, Micaela Bazo</i> .....	281
Creating Resilient and Regenerative Urban Places: A Necessity <i>Forster Ndubisi</i> .....	282
Wadi Hanifah: Landscape Infrastructure for the 21st Century <i>Jean Trottier</i> .....	283
Urban Arboreta: transforming ground through the Knight Cities Challenge <i>Timothy Baird</i> .....	284
Robert Zion's "impractical ideas" 50 years later: a landscape architect's vision for humanizing American cities <i>Carolina Aragon</i> .....	285
Taking the Inside Out - Las Vegas' First Parklet <i>Ken McCown, Jonathon Anderson</i> .....	286
The Las Vegas Sustainability Atlas <i>Ken McCown</i> .....	287
Is Silver Zone effective? Environmental factors influencing elderly pedestrian car accident. <i>Yunwon Choi, Heeyeun Yoon</i> .....	288

Analysis of Green Walls and Roof Gardens of West Texas <i>Louis Mills, Thayne Montague</i> .....	289
Evidence-based Approaches to Medical City Master Planning in a Frontier Market: A case project in Nigera <i>Chanam Lee, Forster Ndubisi, Macharia Waruingi, Sinan Zhong, Di Yang, Sungmin Lee, Isaac Amos, Otobong Amos</i> .....	290
The Restructuring of Public Space: The Tabula Rasa Transformation of the Ithaca Commons <i>Judith Wasserman, Paula Horrigan</i> .....	291
Data-Driven Design Process for Smart Cities <i>Saleh Kalantari</i> .....	292
An Urban River Park Vitalizing New City Development--Applying “Shan-shui City” Concept into the Landscape Planning and Design of Yulong Park in the New City of Fuxin <i>Jie Hu</i> .....	293

## DILEMMA : DEBATE THEME TRACK

Landworks-Sardinia: Post-Industrial Experiential Design <i>Simon Bussiere, Kera Lovell</i> .....	295
Examples of Adapted Ethnographic Approaches for Participatory Design <i>Katie Kingery-Page, Abigail Glastetter, Danielle DeOrsey</i> .....	296
Airport As A Resilient Reserve <i>Sara Favargiotti</i> .....	297
What Use is Research, and for Whom? <i>Marc Treib</i> .....	298
Dilemma: Leveling the Playing Field in Higher Education Between Scholars of Teaching and Scholars of Research Using SoTL Debate: The Benefit-Costs of SoTL in Higher Education Today...and Its Potential Impact on Landscape Architecture Tomorrow <i>Joanne Westphal, Kelly Millenbah, N. Suzanne Lang</i> .....	299
Justice as Justification for Design <i>Hyejung Chang</i> .....	300
Can Discussion Replace Face-to-Face Interaction in Effective Online Design Education? <i>Caren Yglesias, Heather Clendenin</i> .....	301
Making Room for Risk in Play Environments and Play Standards <i>Daniel Jost, Bambi Yost</i> .....	302
Siting the Past/Projecting the Future: Public Debate and Richmond’s Landscape of Memory <i>C. L. Bohannon, Brian Katen</i> .....	303
Terra Interra <i>Katherine Jenkins, Parker Sutton</i> .....	304
Debate, Dilemma & Accountability: Revisiting Values in Landscape Architecture & Environmental Design <i>M. Elen Deming, Kyle Brown, Martin Holland, Catherine Seavitt Nordenson</i> .....	305
Beating the Property Barrier: Building Community to Build Ecology in Cities <i>Joshua Cerra</i> .....	306
Navigating an Epistemological Turn toward Democratic Design <i>Paula Horrigan, Mallika Bose</i> .....	307
Into the Anthropocene: A provocation for 21st century landscape architecture <i>Matthew Tucker</i> .....	308
Black Lives Matter: Design’s Response to the Disenfranchised? <i>M. Margaret Bryant</i> .....	309
Design for "wicked" problems <i>Jamie Vanucchi Karin Limburg</i> .....	310
Alternative Visions for Utah’s Public Lands: A Comparative Case Study Analysis of Public Lands Transfer Precedents <i>Ole Sleipness, Benjamin George</i> .....	311
Alternating Intuition and Analysis: Assessing the Changing Relationship between Research and Design in Landscape Architecture <i>Lee-Anne Milburn, Robert Brown</i> .....	312

## DILEMMA : DEBATE FILM TRACK

In Motion: Reimagining Landscape Architecture Representation <i>Windy Gay</i> .....	314
Animating the Benefits of Landscape Architecture: Four Strategies for Engaging Diverse Audiences through Video Shorts <i>Blake Belanger, Alpa Navre</i> .....	315
Integrating Time-Based Media into the Design Process <i>Natalie Yates</i> .....	316
Animating Poetics of the Konza Prairie, Part Two: Summer and Fall <i>Jon Hunt</i> .....	317
Experience   Contemplation   Intervention: A Site Through Films <i>Kris Fox</i> .....	318
A Pretty Heroic Endeavor – Communicating the Impact of Landscape Architecture on Public Welfare through Video Animation <i>Lovisa Kjerrgren</i> .....	319

## AUTHOR SUBMITTED CONFERENCE PAPERS

\*the included papers were not reviewed.

The Miasmist: George E. Waring, Jr. and the Evolution of Modern Public Health <i>Catherine Seavitt Nordenson</i> .....	321
A Digital Storytelling: Effectiveness on Study Abroad Experiential Learning <i>Ming-ban Li, Tongbin Qu, Ture Petersenn</i> .....	332
Mapping Changes in Tourist Routes as a Tool for Design: the Case of Berlin <i>Jane Fidman</i> .....	340
Creating Outdoor Play Environments which Support the Social Interactions of Children with Autism Spectrum Disorder <i>Keith Christensen, Laura Patricia Reyes Romero</i> .....	353
Landscape Urbanism: An Exploration in Connecting the (Dis-connected) Green to the (Fragmented) City <i>Ming-Chun Lee</i> .....	366
Bioretention design parameters as predictors of pollutant removal efficiency—a data driven approach <i>Runzi Wang, Ming-Han Li</i> .....	381
Interpretive Landscape Design, Race, and Public [His]Story <i>Holly Nelson, Laura Lawson, Anita Bakshi, David J. Goldstein</i> .....	403
The Social Preference for Landscape Performance: A Case study of 4 Chinese Urban Parks <i>Yang Yang, Guangsi Lin, Honghong Zhao</i> .....	415
THE DILEMMA OF THE EDGE: EXPANDING OUR LANGUAGE FOR COASTAL INTERVENTION <i>Nancy Vance, Jacky Bowring, Mick Abbott</i> .....	435
The effects of participation of community gardening on the development of Sense of Community <i>Kyunghee Kim, Yoonku Kwon, Mintai Kim, Cermetrius Bobannon</i> .....	450
Cycling-Friendly Community Designs: Comparative Case Studies of Cities in Germany and Texas, US <i>Sinan Zhong, Chanam Lee</i> .....	471
A Strategic Response Study Featuring “Eco-upgrade” Concept: Rural Landscape Planning & Design in South Zhejiang, China <i>Tiezheng Zhao, Yang Zhao</i> .....	496
Wheatfield-A Confrontation- The Work of Agnes Denes <i>Kevin Benham</i> .....	513
Lawn and Order – Special Tree Victims Unit: A Seminar on Plant Establishment <i>Julie Stevens, Jeff Iles</i> .....	524
Using InVEST to Evaluate the Performance of Urban Growth Management Strategies in Conserving Ecosystem Services in the Urban Fringe Areas of the City of Corvallis, OR. <i>Long Zhou</i> .....	547
Anticipatory Preservation Planning: Protecting Rural Cultural and Physical Landscapes <i>Dominic Fischer, Heather Fischer</i> .....	573
The Sketch Walk: Exploration, Discovery and Discussion of Place <i>Richard Alomar</i> .....	605
Contextualizing data with landscape representation tools: adding meaning and perspective for public evaluation <i>Sarah Schramm, Jacob Mitchell, Jeff Carney</i> .....	615
An ecological greenway studio planning and design process for riparian landscapes in California <i>Steven Greco</i> .....	632



Formed by Water: Case of a Desert City in Iran <i>Nastaran Tebyanian, Maziar Memar, Ron Henderson</i> .....	660
Of Muddy Waters and Presidential Memorials <i>Paul Kelsch</i> .....	684
A Review of Crime Prevention Through Environmental Design Studies in China, 1985-2015 <i>Jingjing Wang, Sean Michael, Jianning Zhu</i> .....	712
Investigating Climate Justice in Green Infrastructure Planning: A case for the Huron River watershed, Michigan <i>Chingwen Cheng</i> .....	728
Turning to a Landscape of Citizenship: the critical effects of introducing landscape architecture to the Cleveland Urban Design Collaborative <i>William Willoughby, Charles Frederick</i> .....	752
Water-based spatial anchor as the sixth element of imageability, <i>Hope Rising</i> .....	774
Rural Interdisciplinary Service-Learning Projects: Frameworks for Engagement within Regional Rural Development Centers <i>Ole Sleipness, Kathleen Ryan, Robert Krikac, Susie Gomez</i> .....	792
Reading the Cultural Specificities of the Iraqi Marsh Arabs from their Landscape <i>Rasha Al-Tameemi</i> .....	828
Design and education of Landscape Architecture's Curriculum in the University of Dammam <i>Ali Al-Sulbi</i> .....	856
Creating Multidisciplinary Teams to Enhance Landscape Architecture Education <i>Robert Dalton, Pat Cranford, Christina DeJong</i> .....	872
An Urban River Park Vitalizing New City Development--Applying "Shan-shui City" Concept into the Landscape Planning and Design of Yulong Park in the New City of Fuxin <i>Jie Hu</i> .....	894

# COMMUNICATION AND VISUALIZATION



# Mapping Changes in Tourist Routes as a Tool For Design: The Case of Berlin

**Jane Fidman Design Workshop**  
jfidman@gmail.com

The relationship between creative mapping and landscape architecture is one process by which thorough analysis of a particular site or city is conducted. Specifically, by mapping project areas in innovative ways, landscape designers are able to understand their sites in a unique light and become more imaginative in their approach to the design. This research argues the truth of the preceding statements while focusing on the specific example of mapping tourism in Berlin. Tourism, the author's interest, is studied specifically as an element that landscape architects have the potential to improve.

The questions that this research seeks to answer include how can planners and landscape architects map and use tourist movement as an analysis tool for design? How have the walking routes recommended by travel guidebooks changed in Berlin over the past fifteen years? This study explores these questions by researching the patterns of tourism in Berlin since 1990 by mapping recommended walking paths from Lonely Planet and Rough Guides tourist guidebooks. While Berlin is researched in particular, the aim of this research is that the methodology used could be applied to other cities in order to assist in coming up with strategies to increase tourism for sites where that is one goal of the project.

The approach to this analysis includes a thorough literature review of academic theory of relevant subjects is undertaken. The subjects covered include: background information on Berlin, information on how tourism changes over time and a review of creative mapping and its impact on landscape architects. Furthermore, an analysis of the Tourist Route Project in Norway is included as a relevant example of how landscape architects can identify formerly touristic routes and rejuvenate them. Following the literature review, prescribed tourist routes for Berlin since 1990 (the year after the wall was destroyed) are mapped. Finally, the findings are compared to other sources.

After the synthesis of this research, conclusions are drawn as to how landscape architects, planners and related professions can use historical tourist data and its impact on urban development to influence the direction of future planning documents and projects. In the end, the study indicates that Berlin has become more centralized over time and there is room for landscape architects to revitalize formerly touristic paths that may have historic or economic value if improved.

# Publication Development as a Tool for Design Education

**Isaac Gertman** Maryland Institute College of Art  
[igertman@mica.edu](mailto:igertman@mica.edu)

**Catherine Seavitt Nordenson** The City College of New York  
[cseavittnordenson@ccny.cuny.edu](mailto:cseavittnordenson@ccny.cuny.edu)

The annual landscape architecture journal PLOT explores emerging landscape phenomena and considers design thinking and the urban landscape. Each issue is curated, edited, and produced by a team of graduate students in the Landscape Architecture Program at the City College of New York's Spitzer School of Architecture.

This paper presents PLOT as a case study for publication development as a tool for design education. It is our assertion that conducting these investigations outside of the typical studio environment allows students to create deeper, personal connections to their work, and strengthens their conceptual thinking. The collaborative editorial structure provides students a thematic platform for critical texts and design explorations, and encourages discussion, reflection, and conversation around a theme. It allows them to make professional connections, and diversifies their approach to landscape architecture with the influences of design, policy, and fine art.

While the editorial team is always comprised of second year MLA students and the same faculty coordinator, it is transformed yearly, creating an engaged continuity with students across the three years of the program: First year students are provided a space for the further advancement of ideas. Third year students submit ongoing research and curate an accompanying film series.

Each volume's theme obliquely relates to topics permeating second year studio work, which the editors choose to explore further. Editors bring individual influences, experiences, and interests to the publication. Through their outreach, submissions are drawn from local, national, and international contributors, including noted landscape architects, artists, and filmmakers.

PLOT is a collaborative work, and editorial meetings are a place of lively discussion, where an issue is formed and sequenced, and ideas fit together. Each volume of PLOT is a negotiation between editors—who challenge each other to explain and defend ideas—to bring together submissions that inspire the most thoughtful discussion from a diverse group of contributors. By bringing a multitude of perspectives to each issue, the student editors are taking a first step toward developing a practice that can synthesize ideas from inside and outside the discipline.

Landscape architecture connects diverse urban systems, and by bringing the editorial process into the classroom, students are able to closely consider their role as designers in a greater continuum, and the scales that they work in (local, global, cultural, disciplinary). By incorporating their own viewpoints and interests, students become stakeholders in their work and thus in their own learning.

# Revitalizing alleys in high-density cities: How urban and landscape design interventions impact the sense of safety

**Bin Jiang** The University of Hong Kong

**Cecilia Ng Sze Mak** The Univeristy of Hong Kong

The back alley is a common but often neglected urban space in high-density cities. Citizens, especially females, try to avoid back alleys because of the problem of safety. Citizens often perceive the back alleys as gray, unsanitary, chaotic, crime-infested places. In fact, many alleys have the potential to be benign or even valuable spaces that can benefit citizens in multiple ways. In this study, we examined people's safety perceptions of existing alley conditions in Hong Kong city.

We used a photo-questionnaire survey to investigate how design interventions to revitalize alleys impact people's safety perceptions. We selected five back alleys in Hong Kong and took panoramic photos of existing conditions. Next, we produced photo simulations for each of the alleys by using Adobe Photoshop 6.0, highlighting specific landscape or urban function interventions that could revitalize the five alley scenes. 218 participants participated in a photo questionnaire to rate the safety of scenes displaying the existing alley conditions and alley interventions.

Our results show that the Cleaning intervention yielded the lowest and very limited effect. The Landscape Only interventions yielded moderate but still insufficient effect. We found that green landscapes with a geometrical style promoted a greater sense of safety than green landscapes with a naturalistic style. Urban Function & Landscape interventions, including the presence of exercise facilities, shops, cafés or pocket parks, can promote the greatest and remarkable effect on the sense of safety.

The gender difference is another important finding. We found that females reported a lower sense of safety of the existing scene and scenes after the Landscape Only Interventions (including “vertical only greening—natural style,” “vertical only greening—geometric style,” “vertical and ground greening—natural style,” and “vertical and ground greening—geometric style.”) than males. However, when Urban Function & Landscape Interventions were included (e.g. “Green Gym”, “Green Shops”, “Naturalistic Green Park” and so on), there was no gender difference in safety perception. Females reported a significant higher sense of safety of the alley with the presence of café.

These findings provide clear evidence for city managers and environmental design professionals to develop regulations or design guidelines aiming to transform the back alley in high-density cities to enhance the sense of safety and mitigate gender disparity.

# Beyond Representation: Landscape rendering as a tool for data collection and design development

**Ponnapa Prakkamakul Sasaki Associates Inc.**

[pprakkamakul@sasaki.com](mailto:pprakkamakul@sasaki.com)

This poster represents a six-year journey of trials and discoveries on the use of landscape rendering techniques. The goal was to think of the drawings beyond their typical constraints as a final representation tool, but rather as an additional medium for data collection and further exploration of design ideas.

Conventionally, landscape renderings are done near the final stage of a project as a representation tool of a finished project to the client or for project marketing purposes. With the aid of software and in the interest of speed, renderings are often outsourced, which risks separating the designer from this critical process. The result is often renderings that are homogenous and lack unique expression. This poster introduces multiple possibilities to revisit the use of landscape renderings, and to repurpose them as more powerful tools for the landscape architect.

The approach was tested at two critical design stages - site analysis and design development. For site analysis, the exploration began by using *the act of drawing as a tool for collecting site inventory data*. Instead the default site visit routine copious photographs, landscape architects made drawings with the use of found materials from the site. This act created an intimacy with the site that allowed the designer to engage all levels of perception that enhance the designer's understanding of the site.

At the design development phase, the experimentation continued by using *scripted drawing as a working space*. By printing out a site photo upon which to sketch ideas, and by overlaying various design alternatives within the physical space, the drawing becomes a more physical link to the site for the landscape architect. The design thinking is done in a three dimensional perspective drawing, in parallel with two dimensional plans. Layers of design revisions are then added after each critique and design review, creating a record of the evolution of the process

The conclusion discovered through testing various methods was that landscape architects should use the rendering process as a tool for data collection during the site inventory and discovery phase, rather than only at final production. Three dimensional graphics and renderings could also be used as a tool to explore design thinking and elevate the designer's understanding of the place. With an appropriate combination of graphic techniques, meaningful drawings can inspire an emotional connection to the site and can be used as a final product ready for client consumption.

# Visualizing 200 Million Trees: a digital mapping narrative

**David Karle** University of Nebraska-Lincoln  
[dkarle2@unl.edu](mailto:dkarle2@unl.edu)

In 1935, Franklin Roosevelt initiated the Prairie States Forestry Project (PSFP), to create a giant “shelterbelt” from the Texas Panhandle to the Canadian border to mitigate the effects of the Dust Bowl in the Great Plains. Due to the territorial scale of the PSFP documenting the project’s evolution is challenging. Over the years the historic PSFP shelterbelts (1935-1942) have been significantly disrupted by changing agricultural policies, farming practices, and Great Plains environmental disruptions. In order to document the current condition of the PSFP shelterbelts we established a digital mapping methodology of the evolution of the PSFP shelterbelts. The story of the PSFP is not one of gradual disappearance or trendy resurgence. Instead it is a narrative of constructing a second nature across the Plains by mixing public and private interests to support social values and individual profits.

Our research initiated a partnership with the United States Department of Agriculture (USDA) National Agroforestry Center in Lincoln, Nebraska, to locate and identify the current condition of the historic PSFP shelterbelts. We examined and documented Antelope County, in north-central Nebraska. Antelope County provided diversity of shelterbelt types with regard to homesteads, farmsteads, cattle, community development, railroad, and pivot irrigation. Antelope County is unique to the PSFP in that it has the highest percentage of shelterbelts in Nebraska (476.88 total miles planted) and the second largest county planted in all six states participating in the PSFP.

The USDA historic shelterbelt planting information are, for the first time in the state of Nebraska, being geo-located in Geographic Information System (GIS). Once manually entered, the GIS data was cross-referenced with a Natural Resources Conservation Service aerial map to confirm current status of historic shelterbelts. Using the geo-referenced map as a guide, aerial photography was taken of the county, making it possible to identify historic shelterbelts and to photograph them. The research found within Antelope County the PSFP shelterbelts consisted of approximately 10% fully intact, 39% partially intact, and 51% removed. 90% of the PSFP shelterbelts have been altered or removed, an astonishing statistic considering the local importance to the farmstead and the regional environmental significance across all six states. The PSFP represents a balance among long-term planning, far-reaching national policies, and a willingness to reconsider core values at the local level regarding the Federal Government’s involvement on private land. This paper / presentation will provide addition insight on the methods and outcomes from the research.

# Cycling-Friendly Community Designs: Comparative Case Studies of Cities in Germany and Texas, US

**Sinan Zhong**

**Chanam Lee**

Cycling has been increasingly recognized for various environmental, human health, and economic benefits (Pucher & Buehler, 2008; Buehler, Pucher, Merom, & Bauman, 2011; Pucher, Buehler, Bassett, & Dannenberg, 2010). Supportive built environments and policies are essential to promote cycling. European countries, such as Germany, Denmark, and the Netherlands, are known for their many exemplary efforts. Cycling levels in these countries are at least 10 times higher than those in the US (Pucher & Buehler, 2008). Empirical studies have also advanced to examine the effectiveness of such policies and environmental interventions, but most of them are individual case studies. Studies comparing the differences between European cities and American cities are limited.

The study is designed to compare cycling-friendly environments between two German cities and one American city in Texas, all of which had a major university. The comparison focused on three components, including (a) policies, (b) community design, and (c) infrastructure/facilities. Lessons from German examples are summarized as guidelines, strategies, and implications for improving cycling environments in Texas.

This study used two German cities (Berlin and Bonn) and one American city in Texas (Austin) for comparison, and identified opportunities and challenges of improved cycling environments in Austin. This two-phased study first evaluated the three study components according to the six dimensions of urban design including functional, morphological, perceptual, social, visual, and temporal dimensions (Forsyth & Krizek, 2011). The second phase involved a more detailed examination of a 1,200m by 1,200m area covering part of a university campus and the surroundings in each of the three cities.

Assessments of multiple evaluation components showed that cycling is much safer and more convenient in German cities than in Austin, due to more supportive policies and bicycle infrastructure/facilities. Both national and city-level bicycle policies existed in German cities, and those policies were geared toward integrating bicycling into the overall transportation system, including transit. Austin, on the other hand, only had city-level policies, and most of its streets are still dominated by automobiles. In terms of the community design, German cities feature mixed land use, high density, and complete cycling networks making cycling highly attractive, contrasting to segregated land use, low density, and discontinuous cycling networks in Austin.

This study offers insights on policies and design interventions that can contribute to promoting safe and attractive cycling environments, ultimately promoting cycling in Texas.



# Just Use Your Imagination: Re Drawing and Re Making in the Rural Landscape Medium

**Daniel H. Ortega** University of Nevada Las Vegas  
[dhortega@unlv.nevada.edu](mailto:dhortega@unlv.nevada.edu)

This conference theme prompts us to debate the 21st century dilemmas that face the profession of landscape architecture. This paper re-visits the opportunity to debate the role that visual representation plays in the imagining, and eventual crafting, of our built environment. In his essay, *Drawing and Making in the Landscape Medium*, Corner “reflect[s] on why drawings have become so extensive and prevalent in the making of landscapes...” Nearly twenty-five years later, we still find ourselves debating the extent that the acts of drawing and making have as means for critical inquiry in landscape architectural education. This submission focuses on the acts of re-drawing and re-making via montage as a way of investigating the latent connection that exists between the phenomenological aspects of a site and the imagining of new landscapes.

The montages that accompany this text are the products of a workshop that was initiated by a group of undergraduate students who wanted to work outside of the design studio to identify... "a catalyst, an agent, [or] a provocateur in the imagining of new landscapes." This work uses a two-tiered methodology that documents the conceptual and digital workflow used to produce the montages, and how that process was structured to facilitate the 'imagining of new landscapes.' In my findings, I will illustrate how the methodology allowed the students to distill the simultaneity of the mnemonic nature of site visits and the phenomenological aspects of those sites. These findings will focus on the montages, and an interview styled narrative that documents the distillation process, which prompted the students to eventually articulate three critically determinant themes used to envision the character of a unique rural landscape; community, rich cultural histories, and incredible natural resources. These themes have become specific protagonists in an assemblage of newly imagined, montaged, landscapes, which add to the dilemma and debate as to how drawing and making engender a critical imagining of landscapes.

# Territorial Contexts: Persuasion and Mapping in Design

**Justin Scherma Parscher** Ohio State University  
[parscher.1@osu.edu](mailto:parscher.1@osu.edu)

Through mapping existing spatial conditions, landscape architects have not only informed discrete projects, but also innovated new modes of visual communication to suit evolving professional practice. Throughout the 20<sup>th</sup> century, descriptive maps were a key part of the professional toolkit of publicity and persuasion, drawing over time from a mixed heritage ranging from Manning and Eliot's pioneering of overlays to CIAM's exhibitions and publications. Most famously in the work of McHarg, maps served throughout not only to shape an eventual design, but to publicly ground the designer's proposition in a convincing expression of fact. Map-centered work in the 21<sup>st</sup> century, from Mathur and da Cunha's *Mississippi Floods* (2001) to Orff and Mistrach's *Petrochemical America* (2013), suggests that mapping has begun to float free of the conventional design project as part of an evolving conception of the professional identity and activities of landscape architects. Despite the active discourse around mapping in landscape since the 1990s and the early work of the landscape urbanists, there remains a need to better understand the historical and ethical place of cartography in the profession.

Through the work of a dedicated seminar, the author worked with students to address the following questions: How can we situate landscape architecture's use of maps in relation to practical and academic developments in geography? How can we relate this to larger historical shifts in the perceived duties and competencies of the designer, as well as the careers of individual designers? How can we critically and ethically apply geographical methods and knowledge to our own ways of making?

To conduct these investigations, the group used an iterative technique of meta-mapping. First, the students identified a body of representative designers deeply involved in geographical work and created initial presentations to situate their mapping activities within their larger bodies of practice. Using critical lenses derived from Barthes, Corner, and geographer J.B. Harley, students moved to analyze representative maps along with accompanying texts. As a group, we then developed montage methods for annotating, editing, and grouping maps to foreground the designers' choices and methods of persuasion, creating meta-maps to relate and present these themes. Finally, students synthesized the results into a collective presentation, categorizing the meta-maps into groups defined by distinct rhetorical strategies, and in the process indicating the cultural positioning of maps in landscape architecture. The resulting work demonstrates the communicative and pedagogical potentials of meta-mapping methods in landscape architectural pedagogy.

# Communicating Risk and Resiliency on Maryland's Eastern Shore: A Visual Preference Study

**Elisabeth Walker** University of Maryland  
[walkerelisabethjane@googlemail.com](mailto:walkerelisabethjane@googlemail.com)

**Victoria Chanse** University of Maryland  
[vchanse@umd.edu](mailto:vchanse@umd.edu)

**Tory LaFemina** University of Maryland  
[lafemina.v@gmail.com](mailto:lafemina.v@gmail.com)

The state of Maryland is already working to foster and advice local-level adaptation planning in Maryland (Maryland Commission on Climate Change 2014). Given the complexities of ecology, economics, and social aspects within the broad context of design and planning for resiliency, a cross-disciplinary approach is needed (Thering and Chanse 2011; Chanse 2015). The growing demands for knowledge-based solutions to the growing complexities of issues such as climate change adaptation and mitigation strategies require transdisciplinary approaches to issues such as climate change and sustainability (Russell 2005; Chanse 2015). One dimension of these transdisciplinary approaches requires the effective communication of sea level rise risks and solutions.

Research indicates some of the challenges associated with communicating local sea level rise risks and solutions. Schroth et. al. (2011) observe the need to engage local communities in shaping *local* responses to climate change. These reasons include: 1) the difficulty of understanding the complexity of climate change science; 2) the climate change information given is often not pertinent to communities; 3) insufficient information on the social and economic impacts of local climate change impacts; and 4) the lack of participatory processes to engage residents (Schroth et. al. 2011; Chanse 2015). This study's larger purpose is to examine the approach and the outcomes of government agencies working with Maryland's Eastern Shore communities to develop strategies in response to local climate change impacts. The short-term goal of this project is to determine a) how agencies such as the National Oceanic and Atmospheric Administration, the Maryland Department of Natural Resources' Climate Change, and governmental agencies on Maryland's Eastern Shore are engaging the public in climate change planning and design responses and b) determining the outcomes of these efforts.

Dr. Chanse and Elisabeth Walker conducted a visual preference survey to determine which visualizations tools and methods are most beneficial to planners to improve risk communication and design responses for residents and stakeholders. In our survey, they asked coastal planners in Maryland to identify the visuals most likely to successfully communicate the economic, social, and physical dimensions of *local* climate change impacts and responses. Using different sea level rise and storm surge visuals developed by landscape architecture professionals and students, as well as visuals from different sea level viewer tools, we surveyed coastal planners for their preferences on visual communicating climate change. This presentation discusses initial findings regarding the use of plan view, section, perspective, photomontages, and other 2-dimensional graphics.

# Probing exhibitions' communicative potential: the interplay of the didactic and the evocative

**Brenda J. Brown** University of Manitoba  
[brenda.brown@umanitoba.ca](mailto:brenda.brown@umanitoba.ca)

Landscape architecture exhibitions typically reflect communication modes within the profession, incorporating traditional representation, contemporary visualization technologies and influences from the fine and popular arts. However exhibitions sometimes tell more complex stories.

This multi-media presentation surveys some noteworthy exhibitions before offering a detailed account of a varied exhibition created for its intrinsic effects as well as its potential leverage for community and institutional buy-in. It concerns a hummingbird habitat restoration project for Tzintzuntzan, a national archaeological site in Michoacán, Mexico. The project is simple in concept; complex in context, implications and execution. Its presentation is correspondingly layered, offering diverse perspectives and employing diverse modes of communication -- both didactic and evocative.

The restoration's simple concept is to bring hummingbirds back to Tzintzuntzan by recreating habitat for the fifteen-plus species inhabiting this part of Mexico's trans-volcanic region.

Tzintzuntzan, an onomatopoeic, Purépecha word, means place of the hummingbirds. Tzintzuntzan is the former ceremonial capital of the Purépecha, who once ruled most of Michoacán and beyond.

The project's complexity stems from its necessary interdisciplinarity (landscape architecture, ecological restoration, acoustic ecology, botany, ornithology, archaeology, anthropology, art history). The exhibition must convey entwined interdisciplinary information along with the envisioned multi-sensorial experiential enrichment at the project's core. It must resonate with people ranging from young children to the elderly, from local residents to international visitors, while building project support and offering education about landscape architecture and habitat restoration more generally.

Therefore, along with traditional design plans, large perspectives and text in Spanish and English, the exhibit includes attractive and engaging charts presenting previously uncompiled information on pertinent plant and bird species painstakingly assembled in collaboration with scientist collaborators. It includes a video in which moving hummingbirds in nature entwine with their portrayals in Mexican arts and crafts, representations collected mostly through field research. It includes a children-oriented animation, illustrating correlations between plants, food and hummingbird populations; a 4-track composition of hummingbird sounds; and an adaptation of *papel picado*, (a traditional Mexican craft) in which a contemporary material is used to playfully and evocatively conjure these winged creatures. These elements also illustrate the more academic 128-page exhibition catalogue that includes essays by project collaborators and other academics.

An exhibition on a project should reflect the project's uniqueness. Diverse uses of didactic and evocative methods can rigorously reveal the project's distinctive components, investigations, discoveries, and implications and respond to its particular institutional and popular contexts.

# Drawing for Disclosure: assembling an understanding of hydraulic fracturing in the Susquehanna Watershed using descriptive/synthetic modeling

**Jamie Vanucchi** Cornell University  
[jlv29@cornell.edu](mailto:jlv29@cornell.edu)

The landscape of extraction constructed by the process of hydraulic fracturing of the Marcellus shale is a special case. Nowhere else in the US do we see mining practice sharing territory with multiple parallel landscape systems, from watersheds and water flows, to habitats and species migrations, households and drinking water, extensive farms and working forests. Mapping and modeling the processes of gas drilling makes visible the flows that are normally obscured. The connection between people and the extraction process occurring in their backyards and home places is obscured because most of it occurs behind closed doors and underground, in the alien world of rock and soil, groundwater flows and methane migration. Although drilling companies are increasingly pressured to release details previously considered proprietary, this information is scattered, buried and sometimes requires fees to access. Visualizing and spatializing data is key to assessing the *collective* impact of many small, dispersed actions by many competing actors.

This paper presents the findings of a research project using descriptive/synthetic modeling to visualize the process of hydraulic fracturing in the Susquehanna watershed in Pennsylvania (Swaffield and Deming, 2011). We use 3D modeling software and scripting to generate 3D maps of well sites and subsurface drill pathways. Also informing the model is a specific and living dataset for every drill pad that includes a driller's mud log, associated water withdrawal sites, mineral rights leases and contracts, and letters detailing tainted drinking water wells, waste water recycling sites, drill cutting disposal locations, gas produced, royalties paid, chemicals used and distances from drill pad to nearby drinking water wells. Once assembled, this model is used assess the impacts of gas extraction infrastructure and associated flows of gas, money, water and waste with other landscape systems such as surface and ground water, forests, farms and settlements through time.

# LOOKDRAWTHINK : drawing and analog practices as research and design tools

**Michael Sánchez** Washington State University

[michael.sanchez@sdsc.wsu.edu](mailto:michael.sanchez@sdsc.wsu.edu)

Landscape architecture is a profession steeped in visual communication. Because of this, students are taught early in their education how integral drawing by hand is to many aspects of design and research. Drawing, as well as other methods of physical representation (intaglio printmaking, wood-block printmaking and watercolor painting), can go beyond capturing information and communicating it to an audience. These analog practices can provide a deeper, more intimate understanding and connection with our research subjects.

The purpose of this poster is to demonstrate how analog drawing techniques benefit research and design and how they can generate richer, more expressive and detailed findings for different types of research, particularly those of design and graphic-oriented research.

Based on research completed in the visual exploration of an historic landscape of mission-era California, this poster explores how the processes of the technique LOOK DRAW THINK profit research in landscape architecture and beyond.

LOOK DRAW THINK is an iterative drawing process that begins by studying a subject with the intent to see it, slowing down enough to capture the subject's essence on paper. It goes on to describe or visualize the subject through various drawing procedures, which serve to reinforce the "seeing" stage. The last step requires the researcher to connect intellectually and emotionally to what they have just put down on paper, intensifying his curiosity and a further understanding of his subject.

Drawings that compliment and reinforce literature reviews, research of manuscripts, photographs and archives, interviews, experiments, site visits, materials and construction documentation become powerful tools that sharpen the researcher's skill and awareness, encouraging additional thoughts, hypotheses and findings.

Additionally, as researcher and ecological landscape artist Khondaker Hasibul Kabir reveals, another compelling benefit to drawing are the relationships one makes and develops with his research subjects (Kabir, 2012). Kabir's experience illuminates the power and potential of incorporating hand-drawing into our work as researchers and designers.

# Representing Resilience: Applications of Graphic Communication in Rebuild by Design

**Blake Belanger** Kansas State University

[belanger@ksu.edu](mailto:belanger@ksu.edu)

Resilience theory is emerging as an important framework for understanding and designing urban areas. The theory involves integrated awareness of the interactions between ecological, economic, infrastructural, and social systems, and how those systems are able to respond to a variety of natural and/or cultural disturbances. Within this body of work, visual aids are frequently used to communicate ideas and spatial/temporal strategies, yet there has been little discussion of effective graphic techniques for representation specific to resilience. The primary objective of this paper is to identify, critique, and synthesize practices for visually representing core concepts and strategies of resilience theory in urban design.

Resilience theory's burgeoning relevance is evidenced by the 2014 international design competition Rebuild by Design (RBD), which focused on reshaping policy and implementation strategies in areas ravaged by Hurricane Sandy. Promoting resilient regionally-scaled design solutions, language in the competition brief draws directly from concepts and vocabulary from resilience theory. Outcomes from the RBD competition provide the most focused and refined applications of resilience theory in professional practice to date.

Using five of the winning RBD proposals, my methods included image analysis and categorization, qualitative review of image application to resilience theory, and synthesis of representational strategies. I used Adobe Bridge to create a keyword-based categorical database of every two-page spread containing images. I categorized the spreads based on four criteria: analysis/proposal, resilience characteristic type, graphic type, and system type. First, I determined if the graphic representation in the spread was addressing existing system conditions or proposed planning/design system interventions. Second, I identified which resilience characteristics were being addressed through images and/or supporting text. I used six characteristics that were explicitly stated in the competition brief and three that I extracted from resilience literature. Next I catalogued the type of graphic(s) the design team presented, using 11 categories of graphic representation. Finally, I categorized each spread based on the type(s) of system being addressed.

Findings first include a quantitative summary drawn from my keyword database revealing total instances in each category described above. Next, I provide a qualitative summary and critique of how RBD teams used graphic representation to communicate resilience characteristics, supported with graphic examples. I conclude by presenting my 6 tenets for representing resilience: keep it as simple as possible, but no simpler; unfold complexity through diversity; use your words; back it up; speak to the eyes; and distill and summarize.



## #OurChangingClimate: A Digital Invitation

**Claire Napawan** University of California, Davis

**Sheryl-Ann Simpson** University of California, Davis

**Brett Snyder** University of California, Davis

The communities forecast to be the most vulnerable to climate change should play a role in examining, problematizing, and designing alternatives to current notions of climate crisis, vulnerability and adaptability. #OurChangingClimate is a digital humanities and environmental design project that encourages diverse communities to observe and critique their everyday environment through the lens of climate change, and to share those experiences through social media. It represents an effort to re-focus the conversation on climate change from global-scaled environmental impacts to one that recognizes the importance of the personal and everyday ways in which community members experience these impacts.

#OurChangingClimate began as a pilot project supported by the University of California Humanities Research Institute and in collaboration with the Oakland-based community organization, Institute for Sustainable Economic, Education, and Environmental Design (I-SEED). In the pilot phase, researchers conducted two workshops with youth groups affiliated with I-SEED. The first workshop introduced participants to environmental science perspectives on climate change, the methods for reading and interpreting urban landscapes in light of climate change, and brainstormed ideas for additional indicators relevant to their experiences of their communities. During the six week period between workshops, participants and the researchers contributed representations of climate change through their own social media accounts. Contributions were aggregated through the use of the hashtag OurChangingClimate. In the second workshop participants and researchers reconvened to analyze themes and meaning in the content they had created and to reflect on the impact of the project on participants. Some of the predominant themes included environmental justice, race, public health, and food security. In their reflections, participants described a greater awareness of their surroundings, and a greater sense of agency around climate change.

The final component of the pilot phase, conceived of by youth during workshops, included the development of a digital invitation to the project. This digital invitation was conceived to 1. Synthesize workshop content, 2. Introduce the preliminary digital network created by the project, 3. Invite community members to contribute their own experiences to the network, and 4. Support sharing capability on existing social media networks. The result is a two minute animated video that links global- and regional-scaled impacts of climate change to the individual-scaled experience of community-members and introduces the preliminary posts and themes that were generated by youth participants. It encourages viewers to explore and contribute to the network, and gain a new, more personal understanding of climate change.

<https://www.youtube.com/watch?v=n01WyPxGzHs&feature=youtu.be>



# The Sketch Walk: Exploration, Discovery and Discussion of Place

**Richard Alomar** Rutgers University  
richard.alomar@rutgers.edu

The growth and popularity of urban sketching (Campanario, 2012), sketch walks and sketch crawls, has brought the practice of on-location sketching to the attention of landscape architecture programs and practitioners (Richards, 2013). The popularity of these groups that promote on-location sketching and share their work with a wide audience of sketchers, has initiated a discussion within landscape architecture on the role of sketching, recording direct observations, mapping and social media sharing in the teaching of design and place-making.

This paper will focus on the Sketch Walk as an activity that combines a series of design based practices that explore, discover and discuss the essence and meaning of place. The Sketch Walk is an effective pedagogical tool to teach sketching and mapping techniques for design and creative place-making studios as well as a creative outreach tool to discuss design, place and vision with the community.

The Sketchwalk, in its many names and forms, consists of travelling through an area and drawing what you see or calls your attention. The travelling can be on a planned course or a self-directed route. At the end of the walk sketchers compare images and thoughts about the place and also share their sketches through social media. This activity is popular among landscape architects, artists, students and art aficionados and provides direct insight into what people find significant about urban space. Both CELA and the ASLA have hosted sketch walks as an academic and practical form for groups to explore, discover and discuss place.

The roots of sketch walking will be discussed, from pre-photographic travelogues, to *plein air* painting and sketch journalism. The socio-political infusion of Situationist thinking (Debord, 1958), and Psychogeographic (Self & Steadman, 2007) and Physiocartographic (Gilbert 2005-2007) operations will also be discussed to set the groundwork for some of the popularity of this world-wide movement. A description of the planning and organization of a sketch walk will be presented and finally, perspectives on the use of sketching, mapping and physical engagement in the landscape as a mode for individual and group discussions of place (Cullen, 1961 & Lynch, 1960) will be discussed to demonstrate sketch walking's potential as a teaching and community outreach activity.

# Landscape representation tools contextualize data, adding meaning and perspective for public evaluation

**Sarah Schramm** Louisiana State University

**Jacob Mitchell** Louisiana State University

**Jeff Carney** Louisiana State University

In working across disciplines with the shared goal of educating the public, it becomes evident that different disciplines rely on different tools for visual communication. At Louisiana State University's trans-disciplinary Coastal Sustainability Studio (CSS), we work with scientists, engineers, and designers to envision and design sustainable systems on Louisiana's coast. In our work we find that data-rich graphs and charts used by scientists and engineers often fall short of communicating the significance of a relationship or process to the public. Visually communicating this meaning is an interpretive step that is necessary for meaningful public engagement.

In Louisiana, the coastal land loss crisis impacts communities, industry, and ecological systems at a massive scale and rapid rate. To address this, the State of Louisiana's Coastal Protection and Restoration Authority (CPRA) developed the *Comprehensive Master Plan for a Sustainable Coast*, which proposes a range of projects to restore large-scale systems across the coast. The investment and coordination needed to accomplish the goals of the Master Plan require broad public support and funding. To achieve this, CPRA must find a way to present complex concepts to the public in a way that is meaningful, convincing, and moving, in order to inspire the will to act among the public and political leaders.

The CSS has been commissioned by the CPRA and other NGOs in Louisiana to develop visual material to convey the complex processes underpinning coastal protection and restoration. Drawing inspiration from work such as Hill's writings on climate change and the sublime, Mischel and Orff's Petrochemical America, and a host of designers and coastal science educators at Louisiana State University, the CSS is developing a visualization approach that bridges the specificity of data analytics and science communication with an aesthetic tradition germane to landscape architecture.

The drawings the CSS produces strive to convey ecological and geomorphological processes, as well as show how these relate to human perspectives and use of the landscape. This approach builds on the framework of *ecological understanding* developed in Hill *et al.* (2002). The melding of science with abstraction enables viewers to experience the ephemerality and potential unknowns existing in environments while providing defensible position for argument and consensus building around specific programmatic objectives.

By integrating the human perspective, we believe the public will be better equipped to evaluate the risks and opportunities of their landscape and understand the benefits offered by the Master Plan proposal.

# DAN KILEY LANDSCAPES IN BARTHOLOMEW COUNTY, INDIANA Materials from the Columbus Indiana Architectural Archives and Planting Typology Investigations of the Miller Garden and North Christian Church

**Maria Debije Counts** Pennsylvania State University  
[mmd16@psu.edu](mailto:mmd16@psu.edu)

**Ron Henderson** Illinois Institute of Technology  
[rhender1@iit.edu](mailto:rhender1@iit.edu)

The paper and presentation will demonstrate the effectiveness of planting typology research and the visualization of dynamic biological processes as an instrument of planting design pedagogy. The paper and presentation will also outline the program established to communicate this research project with a six-week public exhibition, exhibition catalogue, and public panel discussion.

Over twenty of Dan Kiley's projects borrowed from the Columbus Indiana Architectural Archives in what is known to be the largest concentration of his work in Columbus, Indiana, are integrated into the core planting design course pedagogy. Two and three-dimensional mixed-media analytical drawings and models of the Miller Garden, North Christian Church and detail studies augment the exhibit of archival materials and simultaneously serve as context and foundation for planting research and an ensuing 1,000 tree planting design and construction drawing set project.

Large-scale models of the Miller Garden, the North Christian Church and planting typology study models with over 2,000 wire trees and CNC-routed bases made by the students render case studies and planting investigations of archival research in three-dimensions. Planting typologies including one tree/row, two tree/allée, bosque, grid, quincunx, hedgerow and forest developed through 2d and 3d are explored in model and graphically in a series of plans, sections, and orthographic projections. Students later use these investigations to inform their designs. These graphic and model-investigations propose a new effective model for learning about planting design contributing to the pedagogy of planting design in a core planting course.

Kiley's work serves as the context and underpinning for studies which planting typologies and the phenological / morphological nuances within tree species through canopy growth, seasonality, texture, caliper, and form - among other topics are explored and inform planting design work. Lessons learned from careful analysis and representation through archival research suggest new methods for visualizing planting typologies not only as they relate to forming spatial composition, but also in their capacity to take into account that of history, theory, space, and ecology in landscape architecture today.

# Beyond the Map: Critical Cartography as Design Research

**Tania Allen** North Carolina State University  
[tania\\_allen@ncsu.edu](mailto:tania_allen@ncsu.edu)

**Sara Queen** North Carolina State University  
[sara\\_queen@ncsu.edu](mailto:sara_queen@ncsu.edu)

The landscape architect and theorist James Corner has argued “the function of mapping is less to mirror reality than to engender the reshaping of the world in which people live” (Corner 1999, 213). Building on the seminal work of Corner, Alan Berger, JB Harley, Anu Mathur, Dilip da Cunha and others, this paper argues for a critical evaluation of the map that goes beyond the examination of the artifact (i.e. the map) to include the critical evaluation of the activity of mapping (i.e. the conscious choices that we as designers must understand and command concerning visualizing information in space and time) and its impact on the propositional nature of design (i.e. how the activity of mapping influences the decisions that designers are making about where, how and to what extent we intervene).

This paper also builds on the assumption that mapping and visualization are powerful analytical, synthetic and formative research tools which connect design research to space, place and culture. We suggest that moving beyond the examination of the map as an artifact towards a formative process requires a critical methodology which uncovers the agency in mapping’s fundamental constructions of scale, orientation, framing and organization. By formulating methods for critical making, critical analysis, and critical impact, this paper offers a toolkit to move mapping beyond an organizational and visual strategy towards an actively critical and reflective tool that helps designers conceive large systems, individual components and discrete moments for intervention. By asking explicit and targeted questions that challenge the assumptions of the map’s monolithic truth, we suggest that mapping in design research can be particularly powerful when used as a comparative, exploratory and iterative process. The questions of particular relevance involve what is absent (vs. what is included) and how the physical and social fabric influence with one another.

# Collecting the big idea: an exhibition of conceptual visualization in contemporary practice and education

**Simon M. Bussiere** Ball State University

**Quilian Riano** Parsons The New School

**Dustin Headley** Kansas State University

The spark of an idea is often uniquely captured in initial conceptual studies. A sketch for example does not only hint at an idea in the making, but inspires the maker and viewer alike to take imagined artistic liberties. In this moment of conceptual realization, the designer connects a concatenation of dots by filling in the representative voids with their own creative visions. However, some contemporary visualization techniques have resulted in a proliferation of hyper-real, super polished renderings that, at times, distract viewers from the design's conceptual void. In this paper the authors explore this dilemma through a traveling design exhibition – Thinkfast – that deconstructs the process of argumentative visual communication in order to reignite pedagogical discussions about design fundamentals.

The interdisciplinary collection was exhibited at three distinguished academic venues (Ball State University in Indiana, Kansas State University, and the School of Design Strategies at Parsons in New York City) in the 2015-2016 academic year. After an international call for submissions invited work for curatorial review from across several areas of disciplinary focus, twenty-eight pieces were selected from over two hundred submissions for the show and its forthcoming publication. The presentation showcases and collectively deconstructs all stages of the conceptual design process, with sketches and built works by students, early-career practitioners and such well-established designers as James Corner, Chris Reed and Michael Van Valkenburgh. From rough to more resolved, the presentation traces layers of the designer's investment as an idea first becomes visible both through traditional as well as more contemporary imaging methods. Through a careful arrangement that integrates analog, digital and mixed media works, the presentation highlights differences between diverse techniques and triggers debate between design, representation and technology. Taken together, this visual investigation of the conceptual design process serves as a pedagogical tool for aspiring designers and seasoned professionals alike. By bridging creative disciplines, including art, architecture, landscape architecture and product design, the project reveals meaning in the seemingly effortless and often-accidental discoveries that grow out of conceptual visual thinking.

# Evaluating Urban Design Performance Using City Engine

**Elizabeth Scott** University of Idaho  
[bscott@uidaho.edu](mailto:bscott@uidaho.edu)

There is significant evidence that digital and other graphic tools “allow visual perception to be harnessed in the dynamic processes associated with the creation or discovery of new knowledge”(Jessop, 2008). Digital 3D design tools are commonly utilized to achieve a semi-realistic view of a proposed design, while still presenting a simplified or generalized model of the built environment (Ervin, 2001). In recent years, digital tools have begun to focus on parametric or rule-based design. Rule based design offers a benefit of being able to set and report on parameters that can establish performance benchmarks. This has obvious application as the design professions increasingly attempt to meet or exceed sustainability metrics, such as those established in well-known systems such as LEED standards or the SITES initiative. City Engine is a rule-based 3D modeling and design software package that marries GIS and parametric 3D design. It has been developed in large part to enable real-time visualization of design decision making, with the benefits of being geospatially referenced and allowing reporting on specific elements within the design. Two graduate-level urban design studio projects developed through traditional hand and digital design tools have been translated into City Engine. These are reviewed and evaluated using City Engine’s reporting tools with respect to three aspects of sustainability: walkability and connectivity; stormwater management; and form and human scale. The evaluation is based on sustainability metrics outlined in 1) LEED-ND standards, 2) local design and development codes, and 3) SITES standards. The ability of rule-based design software to communicate the effects of design decisions in real-time has been recognized as one of their principle strengths (e.g., Batty et al, 2000). Yet there continues to be a gap between the creation and the evaluation of proposed designs, as shown in these two examples. As digital design tools are more widely applied to a range of urban environments, it is becoming clear that, although helpful as communication and decision support tools, they fall short of providing appropriate guidance for developing sustainable cities in part because the reporting/analysis capabilities focus on individual elements. While this provides valuable information on specific elements, such as stormwater infiltration capacity, it remains challenging to link the performance of individual elements in a manner that allows evaluation of the integrated systems as a whole. There is also a need for design to be equally informed by contextual social and physical science through iterative and participatory feedback throughout the design and planning process (Schmitt, 2012), which can be difficult to capture in the rule definitions. This suggests a need for investigation and further development of analytical linkage.

# Visualizing restoration techniques to facilitate public understanding

**Jacob Mitchell** LSU Coastal Sustainability Studio  
[mitchell@lsu.edu](mailto:mitchell@lsu.edu)

**Karen May** LSU Coastal Sustainability Studio  
[karenmay@lsu.edu](mailto:karenmay@lsu.edu)

The Mississippi River and its delta have undergone massive infrastructural modifications that have created an imbalance between the forces of land building and land loss; as a consequence, Louisiana is now facing a massive land loss crisis. Understanding how deltaic processes interact is essential for the public to evaluate the restoration plans put forward by the State of Louisiana, but the complexities of this environment pose significant communication challenges. Visualization can play a key role in influencing public opinion around pressing environmental issues (Sheppard, Shaw, Flanders, & Burch, 2008) such as the urgent need for a range of coastal restoration strategies in response to the land loss crisis.

This presentation will leverage the visualization work of the Coastal Sustainability Studio (CSS) at Louisiana State University for the State's Coastal Protection and Restoration Authority (CPRA) as a case study in how visual communication about complex landscape restoration strategies can contribute to a better understanding of the multiplicity of solutions required to tackle large scale ecological crises. We posit that clear, easily understood graphic communication can engender more constructive debate around controversial issues by diffusing and debunking extreme, misinformed positions on the value of one particular strategy above another, and informing the public on how each restoration activity should be considered within the broader context of a holistic approach to coastal restoration.

Using materials made for public engagement purposes including work in exhibition format as examples, we present our approach to communicating the need for a suite of restoration techniques. The visualizations articulate the State's restoration and protection strategy while providing the public with the information necessary to understand and evaluate how different project types function and the value of an integrated landscape approach. This approach runs somewhat counter to the tendency of large organizations to inform rather than engage citizenry on large scale planning projects (Perkins & Barnhart, 2005).

This work is being produced in the context of a public debate over the merits of a systems based approach to restoration (sediment diversions) in contrast to direct, mechanical land creation methods (Louisiana Coastal Protection and Restoration Authority, 2012; Mead & Meselhe, 2010). Stakeholders in the fishing community, some of the more vocal opponents to diversions, have had a significant influence on the public discourse through extreme, often polarizing tactics (see Ricks, 2014). As the State is accountable to a broader constituency, this visualization program seeks to educate the public in order to blunt some of the more extreme view on coastal restoration and develop a more informed citizenry. By visually demonstrating how these project types work and are connected, their respective roles in a restoration strategy can be articulated, demonstrating the value of visualization as both a capacity building and planning tool in public policy (Tress & Tress, 2003).

# On the Road Again... Perceiving and Drawing Large-Scale Landscapes of the American West

**Caroline Lavoie** Utah State University

[caroline.lavoie@usu.edu](mailto:caroline.lavoie@usu.edu)

The process of drawing on site is a means for deeper understanding of place, because one must see, internalize and interpret qualities and variations of the landscape to convey the sense of place. The process of drawing a landscape while moving in a vehicle informs the viewer at a different scale and time. This faster pace of perception serves to highlight a form of comprehension of the landscape in its most minimal form, in contrast with photography or video, for example. This poster presentation investigates perception and representation of the large-scale landscapes of the American West in movement. The author uses her own drawings from moving vehicles to test the educational value of using personal connection to the landscape in movement.

The author suggests that the rapidity required by drawing gestures while in motion enhances the process of perception and analysis. It requires an immediate response of the hand—a minimal gesture to represent what is briefly perceived and experienced. In an age of information overload, this minimal rapid response produces a distilled representation of landscape and place. Just as a drawing from a specific position helps us understand the sense of place – large and small – motion drawing helps us understand and capture the essence of large landscapes. This practice shows how rapid and sequential drawing, transects, and other motion drawing techniques help better express the wonder and spirit of the vast American West landscapes.

This poster focuses on three major areas of drawing: **Drawing, Scale, and Interactions (from large to intimate); Drawing and Communication; Drawing and Education.** The first section, **Drawing, Scale, and Interactions**, explores differences between still and moving drawings. Second, for **Communication**, the author contrasts still and moving drawing in terms of: **Perception, Interpretation, Reflection, Awareness, Intervention, and Sharing.** Sharing these experiences publicly through drawing enables us (clients, students, designers, viewers) to gain a better understanding of place at all scales and comprehend some of the processes that have shaped large western landscapes. Third, the poster explores pedagogical value of personal experience and drawing in movement. Landscape perception will always be personal, intimate, and culturally biased and there is great value to express it for design.



# Landscape representation typology in ASLA student awards

**Rebekah VanWieren** Montana State University  
[rebekah.vanwieren@montana.edu](mailto:rebekah.vanwieren@montana.edu)

The American Society of Landscape Architects Student Awards Program began in 2004 with the aim of honoring student work that “gives us a glimpse into the future of the profession” (www.asla.org, 2015). These prestigious awards recognize innovative design and projects in the field, through submissions that include a narrative and several pages of graphics. As such, the student awards are a telling reflection of what is considered to be exemplary, cutting-edge landscape representation at the time. In the present study, we used a content analysis approach to analyze the graphic content of 278 pages of student award winners from 2004-2014 in order to identify the shared characteristics of award winning submissions over time. Examining pictorial types, graphic processes, media, annotation, composition, extent, and style, we document common representation and graphic communication themes. In particular, we investigate how these themes have evolved over time, and their relationship to contemporary landscape architecture theory and practice.

# The Trouble with Scale - Representing and understanding Louisiana's coast

**Karen May** Coastal Sustainability Studio at Louisiana State University  
[karenmay@lsu.edu](mailto:karenmay@lsu.edu)

**Jacob Mitchell** Coastal Sustainability Studio at Louisiana State University  
[mitchell@lsu.edu](mailto:mitchell@lsu.edu)

Coastal Louisiana lost 25% of its land area from 1932-2010 (Couvillion et. al., 2011), a process that continues unabated to this day. Processes that govern the Mississippi River Delta operate across many thousands of acres, yet the driving factors often come down to a few critical inches—the narrow margin between land and water in the wetlands. Visual representations addressing coastal land loss are thus required to operate at multiple scales simultaneously; traditional landscape representation methods are insufficient to describe Coastal Louisiana when grappling with both horizontal compression of surface conditions, and vertical exaggeration of the ground plane simultaneously, to demonstrate relationships between phenomena that happen at a small scale, but produce aggregate effects over broad swathes of the landscape.

This presentation will look at visual communication and exhibit design work conducted by the Coastal Sustainability Studio at Louisiana State University for the State's Coastal Protection and Restoration Authority that conveys the environmental knowledge that underpins their proposal for abate land loss. The approach taken in this work echoes that described by Dee (2004) as *critical visual studies* in that the visual material produced is a vehicle for developing an understanding of key landscape process interactions and relationships and as a tool to communicate this work. Through the process of developing a public exhibit, we are simultaneously uncovering readings of the landscape that aid our communication goals, and investigating the possibilities of communicating coastal processes through innovative approaches to representations that address issues of scale.

The exhibit format provides a unique opportunity to explore and communicate these multi-scalar, landscape issues. This presentation will examine a series of drawings produced by the studio addressing coastal issues and land loss, including hybridized large format images combining multiple drawing conventions, consideration of drawing hierarchy based on viewer orientation to the graphic, narrative presentation through image sequence describing coastal land building and land loss factors at multiple scales, and the use of color as a key to be read across multiple drawings.

It becomes clear that to understand the problem of scale here is to understand why it matters to try and represent the landscape across a range of scales; it underscores this landscape as unknowable in its totality, and techniques of abstraction in representation are essential to telling the story of landscape processes Coastal Louisiana. The investigation of scale in representation through visual work allows us to understand the significance of effects and consequences of the way this landscape is occupied, and it is our ambition that this work could have broader implications through the development of our own understanding of this problem will help better communicate these issues to the public.

# Digital design: Assessing the impacts of utilizing an advanced tablet as the sole mechanism for design.

**David Evans** Utah State University  
[david.evans@usu.edu](mailto:david.evans@usu.edu)

**Benjamin George** Utah State University  
[benjamin.george@usu.edu](mailto:benjamin.george@usu.edu)

**Mark Jensen** Utah State University  
[dmjensen05@gmail.com](mailto:dmjensen05@gmail.com)

**Thomas Terry** Utah State University  
[lpforlife@gmail.com](mailto:lpforlife@gmail.com)

Technological advances have increasingly led to a convergence of digital and traditional hand techniques, providing an opportunity to reconcile what are often viewed as two competing design and production methods. This presentation reports the findings of a series of research projects examining the impact of a Wacom Cintiq Companion, an advanced graphic tablet, on the design process in a collaborative student design project. Unlike a traditional tablet, such as an iPad, the Cintiq Companion has significantly higher drawing accuracy and is a true computer, capable of running full versions of standard design software such as AutoCAD, Photoshop, and SketchUp. By merging work done by hand with the power of digital tools, this type of tool creates the potential to significantly streamline the design process and provide students the ability to simultaneously leverage digital and analog design resources.

Two teams of students participating in a design project were asked to utilize the tablet as the primary design tool. Several other design teams used traditional hand and computer tools to complete the same design project. Students were asked to document their experience using the tablet, and participate in a series of interviews at key milestones throughout the project. This provided a holistic understanding of the use of the tablet on the design process.

It was hypothesized that students would be able to design more efficiently using the Cintiq Companion because they would be able to work digitally, while still maintaining many of the benefits of hand drawing, especially in the early exploration and iteration phases of design. At the same time, the digital capture of these hand graphics enables students to more quickly move their work into the production stage. While many of these hypotheses were validated, the use of the tablet also introduced new difficulties, including the sharing of the device between team members, technical difficulties, and difficulty completing some design tasks. Additionally, the adoption curve was more significant of a hurdle than either the researchers or the students anticipated. The researchers considered the use of the Companion to be a success, as students were able to overlap many of the best features of both the digital and analog world, while at the same time recognizing the need for additional research on the creative impact of using an all-digital workflow.

# Testing Proxemics in The Elevator

**Bambi Yost** Iowa State University  
[byost@iastate.edu](mailto:byost@iastate.edu)

The purpose of this presentation is to demonstrate an innovative, engaging, and student-centered approach to teaching basic environmental psychology, behavior theories and research methods in a meaningful way to first year landscape architecture students and students from other disciplines. One of my goals as a landscape architect and professor is to teach students the value of research, methodology, environmental psychology and human behavior theories, and application of knowledge so that they might be better at designing with people in mind. I accomplish this through project and place-based teaching methods which reinforce critical thinking, intrinsic motivation, creative experimentation, data analysis, synthesis, and experiential learning.

I have been using film in my class as a way to motivate and investigate real world human-environment conditions and effects for 5 years. Students are challenged with 3 major research projects: 1) a *William Whyte*-style observation video at one of three local sites; 2) Observation and mapping, diagramming, with images and drawings; and 3) Testing proxemics and/or Territoriality. All of the project and place-based research films created are complimented with research papers and in-class discussions about how these findings relate to physical environmental design.

In this showcased student-directed film, "Testing Proxemics in an Elevator," a group of multidisciplinary Iowa State University students test Edward T. Hall's (1966) theories and findings of proxemics. Their creative and fun experiments reveal a lot about people and their physical and social environments. This pedagogy has been evaluated over time using the following measures: 1) correlation of student retention of information on exams, 2) student responses to the film projects as demonstrated through in-class discussions and reflection papers during the semester, and 3) conversations years later with former students. My findings include: 1) There is a positive correlation of student knowledge gains related to film research projects on exams; 2) There is an overall positive response to the benefits of autonomous, student-directed research condensed and shared in informative film; 3) Students and graduates have approached me years later to say that the experiments and videos they created are still some of their best memories and longest lasting lessons from their academic studies.

In conclusion, innovative, engaging, and student-centered pedagogy which utilizes technology, basic design skills, and reinforces learning matters if we are to create self-motivated, critical thinkers and designers for tomorrow.

# Hidden History: Using digital tools to discover the historical landscape around us.

**Amanda Hughes** Utah State University

[amanda.hughes@usu.edu](mailto:amanda.hughes@usu.edu)

**Benjamin H. George** Utah State University

[benjamin.george@usu.edu](mailto:benjamin.george@usu.edu)

**Ole R. Sleipness** Utah State University

[ole.sleipness@usu.edu](mailto:ole.sleipness@usu.edu)

**Sri Ram Ramineni** Utah State University

[sriram.vijf34@gmail.com](mailto:sriram.vijf34@gmail.com)

The landscape is a palimpsest, with countless overlapping layers of natural, built, and cultural history and meaning. To the trained eye, and with patient observation, many of these layers become visible, painting a rich tapestry around us, woven with threads of geology, ecology, history, and cultures. Unfortunately, many people never come close to glimpsing the fuller tapestry of the landscape, but only see the most apparent or well-known features of the landscape, while the rest of the landscape remains hidden.

This is especially true for visitors and tourists in an unfamiliar landscape. These individuals typically rely on guidebooks and popular tourism-themed websites to interpret the landscape around them. These resources often direct visitors to the same landmarks, and often only the select few sites recognized as preeminent destinations. Lost in this experience are the many underlying layers that create context and meaning within the landscape, and the plethora of sites that fail to make the “best of” list.

This presentation describes the creation and use of a mobile application designed to uncover the hidden history and layers of a landscape. Geo-tagged landmarks are used as triggers to provide visual and audio commentary to a visitor, with an emphasis on facilitating the discovery and understanding of many elements that would have otherwise remained hidden. While other apps provide prescribed routes, often perpetuating the problem of only revealing well-known landmarks, our app responds to the user’s movements, in order to make them aware of the landscape around them, regardless of the paths they chose to explore. While well known landmarks are included in the database, emphasis is placed on lesser known elements within the landscape and features that are not readily apparent to the casual observer. Through the use of this responsive mobile app, greater meaning in the landscape is uncovered and more of the landscape’s history is revealed.

# Coded Landscape: Programming Natural Phenomena

**Aidan Ackerman** Boston Architectural College  
[aidan.ackerman@the-bac.edu](mailto:aidan.ackerman@the-bac.edu)

Generative design software offers a powerful approach to examine and model occurrences in the natural world. Using simple open-source visual programming tools, natural systems within the landscape can be documented and visualized, allowing them to be understood more deeply. How can we use these tools to model natural phenomena in ways which allow us to more effectively test their applications? To address this question, the author tested multiple software workflows and imaging strategies, documenting and comparing them to identify the most productive factors in authoring an open-source programming system for simulating natural systems. For the purpose of this study, a natural system is defined as: a group of naturally-occurring, interdependent, and routinely interacting phenomena.

This study focused specifically on modeling plant growth through examining the interaction between native northeastern plants, simulating environmental factors such as temperature, wind, and water. Software was used to model aspects of growth, decay, interactivity, and motion. Simulations emphasized the coexistence of these elements within landscape architecture, introducing constructed materials, scales, and adjacencies. Immediate interactions in real time served as a starting point, however long-term impacts over years was the primary output of this research. Among the many criteria examined were ease of use, modification, portability, scalability, and visualization output.

The results show that the most critical factors for successfully modeling natural phenomena within the landscape are visual output and scalability of systems. The ability to visually test natural phenomena provides an immediate resource which is easily readable and compliments other visual work such as site drawings, diagrams, and renderings. The potential to magnify code output to simulate the implications of natural phenomena in larger scales indicates that this technique will be relevant to landscape architecture analysis and design.

By modeling the particular intersection of programming code and natural systems within the landscape, this study offers instructors and practitioners with tools to more deeply test and analyze natural systems within the context of site design. These tools may make visible the ways in which the materials and methods of the design will change and wear over time, or how a planting design might develop over several years. In the future these simulations might allow quantitative performance outcomes to be generated and quickly tested, revealing ecological aspects of landscape performance which are best understood over longer time scales.

# The Means of Physical Transference: The Experiential Path Toward Hybrid Graphics

**Kris Fox** University of British Columbia  
[kfox@sala.ubc.ca](mailto:kfox@sala.ubc.ca)

This paper explores the student work generated in a studio at the University of British Columbia entitled **::LAND<>ART:: The Sacred and the Profane**, wherein I challenged each of my students to establish a position within the evolving dialog between landscape architecture and land art. The studio began with the premise that designing both begins and ends with the body; transitioning from movements around a site to movements of the hand on paper or with physical models. The precedent for this ‘transfer of energy’ was derived from the work of several prominent land artists who employed several different methods of capturing sequences of spaces and events, measurements of time and seasons, and spirit of place. One of the learning objectives was to see how the process employed by these land artists would impact the design process of the students when analyzing and designing their project sites.

The students were asked to respond by creating short films, box constructions, drawings and models drawing inspiration from the physical process methods used by several prominent land artists. Robert Smithson, Nancy Holt and Dennis Oppenheim became the launching point for the creation of 2D/3D/4D graphics based on site experiences, particularly Oppenheim’s 2D collages for capturing body, site, image, time and process, and Smithson’s *Spiral Jetty* and Holt’s *Sun Tunnels* for capturing sequences of bodies, spaces and events in 2D/3D/4D. Though not a land artist, Joseph Cornell’s ability to capture artefact, place and timelessness was introduced as a way to inform conceptual models.

The students were presented with a binary of two sites: the ‘pristine green’ wherein they sought out Mircea Eliade’s “sacred mountain” and ‘the weathered grey’ where they searched for J. B. Jackson’s elusive ruins. With this backdrop, students were asked to ‘find themselves’ in two vast landscapes, a process that started with walking, hiking, cycling and canoeing to explore these sites, seeing them in new ways they did not expect. They were asked to find themselves through exploration and new site processing techniques. In the end, they connected and harnessed physical acts on site, “*moving, seeing, finding, re-finding and recording*” with more physical means of creation in the studio through transfer graphics, collage, films and models. The multi-media projects from the studio I have selected capture this vitality of energy generated from student experiences on site and follow the process of design exploration to the final record of work.

# DESIGN EDUCATION AND PEDAGOGY





# The Creative Study Tour: a new approach to developing creative leaders in Landscape Architecture

**Ryan Hargrove** University of Kentucky

[ryan.hargrove@uky.edu](mailto:ryan.hargrove@uky.edu)

Experiential learning is synonymous with the acquisition of creative thinking skills in design education, specifically landscape architecture. How may we as educators continue developing these skills in our students as they evolve generationally and with the demands of the profession? This presentation will share a series of innovative pedagogical approaches and subsequent research related to the development of creative thinking abilities. Ongoing research findings will be presented that support the value of extended educational experiences in the development of creative thinking skills.

The Creative Study Tour was first introduced in 2014 as part of a research partnership grant. This project is an extended educational experience that provides an opportunity for a select group of landscape architecture students to travel across the United States in search of creative knowledge. The idea behind these trips is to meet with creative individuals in various creative disciplines and talk about their creative narrative, exposing students to the value and power of creative thinking. The second Creative Study Tour in 2015 was able to strengthen this experience within the landscape architecture department and expand through collaboration with other universities. Students participating in the CST in both 2014 and 2015 were tested both pre and post semester to determine the impact of the experience on creative thinking, metacognition and motivation. A battery of creative tests measuring both convergent and divergent thinking was selected taking into account the various ways creativity can be defined. Results indicate that students who participated in the Creative Study Tour scored significantly higher on creative measures as well as metacognitive awareness and intrinsic motivation.

The goal behind this project was to help ensure that landscape architects become leaders in solving the most challenging creative problems of our lifetime (water scarcity, global warming, food scarcity, etc.) These are the types of problems educators in landscape architecture should be asking students to respond to through creative planning and design solutions. In order to prepare students and ultimately professionals for this task we need to identify, value, and develop creative thinking skills through advanced experiential models for learning. Exercises like the Creative Study Tour are an essential piece in making this happen by emphasizing experiential learning and self-reflection. This project and others like it have the potential to be groundbreaking in their impact on future landscape architecture professionals.

# The Perceived Effects of Flipped Teaching on Knowledge Acquisition

**Galen Newman** Texas A&M University  
[gnewman@arch.tamu.edu](mailto:gnewman@arch.tamu.edu)

**Jun-Hyun Kim** Texas A&M University  
[jhkim@arch.tamu.edu](mailto:jhkim@arch.tamu.edu)

Increased demands for technological integration in higher education in design have resulted in new forms of course instruction such as flipped teaching. Under the flipped approach, students learn course materials outside the classroom while active learning methods are employed in the classroom. Increased usage of flipped teaching has inverted not only the classroom, but the entire teaching paradigm. Current pressures for increased enrollment in higher education design programs combined with advances in technology have facilitated flipped and blended/hybrid models of teaching to increase active learning (Hobbs, 2013). While blended/hybrid teaching seeks to create student learning experiences that flow back and forth between face to face and online (or at least technologically supported) situations, flipped teaching exposes students to course material prior to class time (with or without the use of technology), allowing for increased interaction and engagement with the instructor during course time (Ellis et al., 2006). While the traditional lecture style of teaching remains the norm (Thomasian, 2011), flipped teaching methods have been widely applied to aid instructors struggling to teach newly developed large classes which cover vast amounts of material in a limited time and cater to a multitude of majors.

While momentum for the flipped approach has gained traction, little research has been conducted on the subject, especially in the design fields (Moravec, et al., 2010). This study examines the perceived effects of flipped instruction on knowledge acquisition in undergraduate students through a survey of 183 students, a course covering the History of Landscape Architecture was utilized to assess the perceived effects of flipped teaching on knowledge acquisition. It was assumed that if a student perceives that they are learning more and are benefiting from a certain type of course format, they are likely to have higher levels of engagement and perceive greater value from the course, and that this may lead to better performance and increased rates of persistence and completion. Six of the fifteen week course operationalized flipped instructional delivery. Results from the survey were then utilized to analyze the overall perceived effectiveness using five measures – information communication, information accessibility, information stimulation, information interaction, and information accumulation. Results indicated many positive effects of flipped teaching and suggest that as student's perceived learning improved as time spent using learning management systems increased. While perceived knowledge acquisition tended to increase in most students, technological incompatibilities prevented the flipped approach from being fully accepted.

# Effectiveness of Using Digital Storytelling on Abroad Experiential Learning

**Tongbin Qu** Texas A&M University

**Ming-Han Li** Texas A&M University

**Ture Petersenn** Akademie für Internationale Bildung

Digital storytelling is a short form of digital media production that allows ones to share aspects of their life story. It has gained popularity in higher education since the late 1990s in the US due to a great extent that media production techniques, hardware and software becoming much more accessible and affordable (Center for Digital Storytelling, 2015). The purpose of the study is to assess the effectiveness of digital storytelling as a reflection technique in the study abroad setting. In this presentation, we will introduce the process, result and evaluation of the application of digital storytelling on a course taught abroad. In summer 2015, 13 Texas A&M University undergraduate students went to Germany to learn about sustainable communities on five major subjects: water, energy, urban agriculture, recycling and transportation. The Academy for International Education (AIB) based in Bonn handled logistics, arranged tours and invited guest speakers. In one of the assignments, students were required to submit their own 3-minute videos in which they must reflect on their learning and tell stories using their voice. Prior to the trip, students were instructed to bring a laptop computer video editing capabilities for the trip. After arriving Germany, students learned about digital storytelling, collected photos and video clips, and wrote a script for the video during the course period. At the end of the 4<sup>th</sup> week, students presented their rough cuts and evaluated their perceived benefits of different learning and assessment tools. After returning to the US, students submitted their final videos. The survey results show that five out of 13 students have never produced a video before. Eight of them heard of “digital storytelling” but only three have done it before. Students compared digital storytelling with four other assessment tools in terms of their perceived effectiveness in reflecting the Germany experience: writing a final paper, taking a final exam, doing a team project and making a final presentation. The result shows that digital storytelling was rated the most effective tool in reflecting their experiential learning. Students also ranked seven different methods in helping them understand sustainable communities. The order from the most to least effective methods are: guided outdoor tours, host family, guided indoor tours, lectures in classroom, professional conference, interaction with classmates and personal tours. The presentation will conclude by discussing the advantages and disadvantages of using digital storytelling, appropriate courses to be applied and what this means to landscape architecture education.

# Drawn to Learn: Strategies for Visual Note Taking in Landscape Architecture Education

**Elizabeth Boults** University of California, Davis

**Sahoko Yui** University of California, Davis

Cognitive theories of multimedia learning support drawing and imagery as effective means of transferring knowledge across contexts; visualization and concept mapping have proven to increase comprehension and ideation. From Edward Tufte's *Visual Explanations*, to Temple Grandin's *Thinking in Pictures*, the relationship between visual thinking and critical and creative problem solving is well documented. Research has shown that thinking visually – drawing, mapping, diagramming, and employing visual metaphors – can help one process and recall information. This presentation will focus on the application of visual thinking techniques, particularly visual note taking, as a tool to facilitate higher-order learning.

Visual learning requires the development of two skills: visual literacy and visual thinking. Visual literacy is the ability to understand information through visual media; visual thinking is the application of visual literacy—the ability to communicate using pictures and graphics. Ours is a visual culture, and increasingly we negotiate the world through images. The generation entering college are primarily “digital natives” who were exposed to images earlier and more intensely than any other generation; they are intuitively visual learners and communicators. Visual note taking is an ideal learning tool for digital natives; it is a skill which takes advantage of our brain's natural ability to comprehend information through pictures, symbols and illustrations.

This presentation will discuss the outcome of a campus-wide freshman seminar dedicated to visual note taking, and the efficacy of particular visual note taking exercises in two different courses in an undergraduate landscape architecture curriculum. We will comment on the potential use of visual notes in graduate student research to communicate complex processes and methodologies, and argue for the need to incorporate visual learning techniques, such as visual note taking, in the classroom, to adapt to incoming student populations. The connection between visual note taking and graphic recording, as well as the dominance of infographics in design, will also be examined.

As visual thinking strategies become more integrated into Common Core and IB curricula at the K-12 level, which recognize design as an applied art, landscape architecture educators have begun to advocate for more inclusive learning opportunities (STEAM rather than STEM) to attract students into their professional degree programs. In this perspective, our topic relates to the conference theme of ‘dilemma: debate’ in the context of how landscape architecture is positioned in academia: with science or the humanities?

# Rethinking the Five-year BLA; Alumni Reactions and Concerns

**Charles Klein** Texas Tech University  
[charles.klein@ttu.edu](mailto:charles.klein@ttu.edu)

**Johnathan Ulmer** Texas Tech University  
[jon.ulmer@ttu.edu](mailto:jon.ulmer@ttu.edu)

Bachelor of Landscape Architecture (BLA) programs across the U.S. are developing strategies in response to low enrollment. Many have moved from the traditional 5-year model to a 4-year model. As the cost of education increases, a fifth year in college is a deterrent. Furthermore, 5-year BLA programs compete against architecture and engineering programs that offer a 5-year Master's degree. The Landscape Architectural Accreditation Board (LAAB) specifies a minimum of four academic years for a first-professional baccalaureate program. Texas Tech University is facing similar enrollment issues. However, before considering program revisions, the faculty wanted to survey alumni to solicit their opinions.

It was decided to conduct a paper survey, with an online option. In order to insure the validity of the alumni survey, a methodology was developed that first defined the population as all program alumni (N=1200). Two subgroups were identified and a stratified random sampling methodology was used (n=450) to insure that each subgroup was adequately represented and that each individual in the population had the same probability of being selected to participate.

A preliminary questionnaire was prepared and reviewed by the faculty and a pilot study was conducted to insure its reliability. Paper copies of the final questionnaire were then mailed to the sample groups. An email was also sent notifying them that a questionnaire would soon be arriving. Both the email and the paper copy had a link to the online option. Only the sample group was emailed in order to preserve the integrity of the random sampling methodology. A total of 76 questionnaires were returned for a 16.9% response rate. Because of the lower than expected response rate, a non-respondent follow-up methodology was used to confirm the validity of the findings.

Support for a 4-year BLA was positive: 52.7% approved vs. 18.9% opposed; 23.4% were neutral. There was similar support for a 5-year MLA program. Respondents indicated that the length of a BLA degree would not influence their hiring decision (68.92%) and that they would recommend a 4-year BLA program to high school student (35.14%). Open ended questions allowed respondents to offer comments. Many were concerned that "There is simply not enough time to learn the material in <5 years." Other noteworthy comments included "It would probably be very tough the first year" and "Finding qualified instructors." Other open-ended responses were very informative as were correlations between demographics and survey specific responses.

# Landscape Architecture's Role in an Award-Winning Interdisciplinary Sustainability Program

**Joseph Ragsdale** Cal Poly San Luis Obispo

[jragdsal@calpoly.edu](mailto:jragdsal@calpoly.edu)

**Beverly Bass** Cal Poly San Luis Obispo

[bjbass@calpoly.edu](mailto:bjbass@calpoly.edu)

For over 20 years the Sustainable Environments (SE) program has offered university students an opportunity to enhance their undergraduate degree with an interdisciplinary minor. The minor's curriculum enables students to understand the principles, concepts and problems of sustainability with global, regional and local perspectives and then to implement sustainable environmental design projects within the university and local communities. Structured around two core upper-division courses (an interdisciplinary overview lecture and a studio-like, project based class), the minor includes additional coursework from across campus. The minor is housed within the Environmental Design College and core courses are team taught by faculty from the architecture, landscape architecture, and city and regional planning departments.

Participation is open to all university students with most students enrolled in the minor coming from one of the five departments within the environmental design college. In recent years, the faculty has noted declining participation and interest by landscape architecture students. The dilemma this study explores is, why? The purpose of this study is to conduct a case study analysis that examines perceptions and trends in enrollment in the minor and how they affect participation. This research will fill a gap in the paucity of research about the value of sustainability education in landscape architecture. A preliminary literature review finds most articles focusing on the integration of sustainability into architectural programs (Altomonte, et. al, 2014; Trebilcock, 2011) or broadly into higher education (Jones, et. al., 2010; Orr, 1991). A few articles connect sustainability with landscape architecture programs (Green, 2000; Brown and Jennings, 2003; Lenzholzer and Brown, 2013) although not with an interdisciplinary approach that integrates multiple disciplines.

The study includes a literature review; an analysis of enrollment data in the minor and required courses; a survey of current and former SE students to determine the perceived value, importance, and level of interest in the topic; and a second survey of all landscape architecture students to determine the level of familiarity and knowledge of the subject, prior education in the subject, interest level, intentions and reasons for participation or nonparticipation. The paper will provide an overview of the SE program, data on landscape architecture student participation and the results and analysis of student surveys.

# In Praise of Field Studies

**Joern Langhost** University of Colorado (Denver)

**Patricia McGirr** University of Massachusetts

**Hala Nassar** Clemson University

**Joni Palmer** University of Colorado (Boulder)

**Karen Wilson Baptist** University of Manitoba

“A field study refers to research that is undertaken in the real world, where the confines of a laboratory setting are abandoned in favor of a natural setting” (Persaud 2010, 489).

Field studies are a common pedagogical component of landscape architecture curricula. Why? Field studies enrich student experiences. They provide opportunities to become immersed in new contexts dissimilar to those in which we teach and students learn. They also expose students to the richness and diversity of the people and landscapes where they study. The socio-cultural benefits of being in the field are intrinsic – they provide opportunities for students and instructors alike to reflect on their individual and collective expectations and assumptions in relation to the perceptions and actualities of what they experienced. Field studies can expose students to unique natural and cultural places and exemplary design projects in dynamic locations, assuming that these experiences will improve their design projects and deepen their understanding of local and regional context and history. Field studies may be inclusive of involving students in philanthropic components such as design builds in disaster-struck cities and regions or providing services to communities.

In an age where instrumentalism is creeping deeper and deeper into university curricula, educators are required to provide evidence that students are deriving value from their experiences. The impacts of field studies experiences on student learning are difficult to measure directly, and learning outcomes are frequently vague. “Deliverables” are often inclusive of field journals, reflective writing, papers or presentations, emphasizing student’s individual experiences, perceptions and reflections. This panel discussion will probe the pedagogical significance of studies in the field, incorporating research from relevant literature and educator experience. The ambition is to highlight the value of field studies as a pedagogical necessity and provide reflections on best practices to enrich and critically contextualize experiences.

# Interpretive Landscape Design, Race, and Public History

**Holly Nelson** Rutgers University

**Laura Lawson** Rutgers University

**Anita Bakshi** Rutgers University

**David J. Goldstein** National Park Service

Ethnic conflict has flared across the country this past year. How can a design studio integrate design education with focused discussions about ethnicity, difference, and social change? This paper presents a case study where students in the St. Croix Praxis studio at Rutgers collaborated with the National Park Service (NPS), St. Croix, USVI, to develop alternative interpretive landscape plans for the Christiansted National Historic Site. The site is associated with the archeological remains and standing architecture of a slave market and its administrative function. The slave market site is the largest, most complete, structural remains of the mercantilism associated with the Trans-Atlantic Slave Trade; the market itself is mostly subsurface, under a central lawn and a main street through town. Few traces of this important history remain, yet the overwhelming majority of the local population can trace its genesis to this site.

To more purposefully address issues of ethnicity and identity in design, we led the class through a series of conceptual exercises with visits to mainland NPS sites and virtual/personal experiences. These open-ended, exceptionally creative “warm-up” exercises shook students out of their social comfort zones in preparation for site design. We believe this studio created the space for students to explore their own stories relative to culture, history and ethnicity and, as a result, they more flexibly interpreted a public history site.



# Capstone Learning: Assessing Curricular and Professional Learning Outcomes.

**David J. Watts** Cal Poly San Luis Obispo

**César Torres Bustamante** Cal Poly San Luis Obispo

**Joseph Ragsdale** Cal Poly San Luis Obispo

The challenge continues for educators to prepare students for the complexity of today's design dilemmas. Six years ago, the landscape architecture faculty revised the capstone sequence of a five-year BLA program to better prepare students to meet emerging societal and ecological challenges. Refreshed course learning outcomes facilitate the achievement of prescribed goals and objectives for the department, university, and profession (1). Student work from the sequence also exemplifies the culmination of the entire faculty's teaching efforts and supports Stigler and Hiebert claim that "teaching is clearly responsible for learning" (2). The capstone studio faculty relies on a variety of teaching techniques to advance the learning outcomes, such as lectures, desk crits, peer and professional reviews, and recollection of student learning in previous courses. These techniques have been identified as providing students with the opportunity to explore new design approaches and the ability to solve complex problems (2).

There is very little relevant literature or scholarship addressing the assessment of senior capstone sequences. This paper contributes to expanding the research by examining the role a capstone sequence plays in meeting department, college, and university learning outcomes through a longitudinal study based on self-assessment analysis. The assessment analysis utilized by the program is the "talent development assessment approach" which affords longitudinal assessment of student achievement during their enrollment in the program (3). It examines the change, improvement, and growth of student achievement over time through a periodic review of their quantity and quality of work (3). The senior capstone sequence provides the opportunity for a final assessment of the level of individual achievement attained at the end of the curriculum. Indirectly, this assessment approach also provides an opportunity to assess teaching techniques being employed by faculty throughout the curriculum. This secondary assessment of teaching techniques promotes talent development more indirectly as it enlightens and informs the educator about current program policies or practices (3).

A variety of resources were utilized in the self-assessment analysis. These included the university's defined framework for assessment, which served as the foundation for the analysis (4) in conjunction with established protocols for assessment of course learning outcomes (1). Combinations of formative and diagnostic assessment tools employed throughout the curriculum were also utilized (5). Additionally, external reviews from the institution, practicing professionals, and from national accreditation visits completed the data sources. Results of the assessment indicate that the course is meeting and in some areas exceeding all learning outcomes identified with the course. More importantly, the capstone sequence and unique format produces a robust, and diverse body of student work that is contributing to the advancement and broadening of the profession of landscape architecture.

# The Effectiveness of Hands-on Design-Build Learning Opportunities in Landscape Design Studios

**Jun-Hyun Kim** Texas A&M University  
[jhkim@arch.tamu.edu](mailto:jhkim@arch.tamu.edu)

**Runzi Wang\*** Texas A&M University  
[runzi0305@gmail.com](mailto:runzi0305@gmail.com)

**Ming-Han Li** Texas A&M University  
[mli@arch.tamu.edu](mailto:mli@arch.tamu.edu)

Providing students with high-impact learning activities emphasizing hands-on learning opportunities are vital for higher education. Previous research supports benefits of hands-on learning for students which include higher motivation to learn, and more independent thinking and decision making skills based on direct evidence and experiences. In the landscape architecture discipline, students need to learn the decision-making process to solve complicated and multi-dimensional problems, the highest quality learning experiences arise when knowledge is combined with direct experience.

The main purpose of this study is to assess the effectiveness of hands-on education in a landscape design studio course that included a design-build project. During the 2015 spring semester, 22 students in the Bachelor of Landscape Architecture students at Texas A&M University (TAMU) designed and built a rain garden. The project site was located approximately 2 miles from the studio on campus, in a nature preserve. Participating students were asked to answer two surveys in two rounds of data collection comparing the pre- and post-measurement. The students responded the first survey prior to designing and installing the rain garden, then they answered the second survey after implementing their design solutions at the project site. Both surveys asked same questions to evaluate the effectiveness of hands-on learning on improving their knowledge, skills, and satisfaction before and after participating in the project.

The preliminary results reveal that students' hands-on learning could significantly improve their knowledge of design process, construction process, plant materials, low impact development applications, and sustainable development. In addition, their satisfaction to the course delivery was significantly higher after participating in the project. Students also answered that the hands-on learning opportunity enhanced their communication and collaborative skills. One way of variance analysis indicated that male and female students have significantly different perceptions of class assignments and help from instructor during the hands-on learning process. This study supports earlier findings that hands-on learning experience enables to offer high-impact learning opportunities not only by improving their knowledge, but also by nurturing their creative thinking and problem-solving skills beyond the traditional classroom experience. The hands-on learning project could offer students to learn how to design, construct, install, and maintain landscape features, which is a process that they will practice in the real-world.

\* This research was supported by the 2014 Schob Mini-grant Program of the Department of Landscape Architecture & Urban Planning at TAMU.

# A Macro Approach to Teaching Planting Design

**Susan Tomizawa** Ball State University  
[satomizawa@bsu.edu](mailto:satomizawa@bsu.edu)

**Ann Hildner** Ball State University  
[aehildner@bsu.edu](mailto:aehildner@bsu.edu)

Despite a growing body of work in which planting design is a significant component of projects in the field of landscape architecture, planting design in LA program course offerings is often viewed as playing a supporting role in the design of small and large-scale spaces. This paper presents an approach to teaching planting design in which students in a third-year undergraduate planting design studio maximize the use of plant material to deepen their understanding of the art of making engaging places with distinct identities. It also summarizes the course content and pedagogy used to teach students to use plant material as a key element in shaping the structure of exterior spaces. The importance of this holistic approach is that it integrates planting design and spatial design rather than relegating plant material to the role of an adjunct component. With this approach students begin to understand that plants with their expansive species variation, canopy habit, and form have the potential to influence the strength of a design.

The need for a macro approach in planting design is evidenced by the many reference books which rely heavily on descriptions of the functional aspects of plants as well as the micro-scale aspects of planting design that focus on color, texture, habit, or seasonal interest. Such references, while valuable, do not provide students with sufficient knowledge of the larger more significant contribution plants provide in the design and shaping of spaces. Specific references that address the macro approach will be discussed.

The method of instruction includes a progression of studio projects from small-scale site design to more complex designs in which students rely on plantings as integral to shaping the form and fabric of the landscape (Dee, 2001). Sequential lectures on basic design concepts and elements of visual design in the landscape (Bell, 2004) provide students with case studies and reinforce the idea of employing a visual vocabulary of design and of planting design, in particular.

In order to assess the outcome of this approach, students were required to rework a previously completed studio project by applying the design concepts reinforced in the planting design studio. This studio assignment resulted in projects being elevated to portfolio-quality work as determined by both instructors and students, illustrating how this macro approach to teaching planting design results in substantially improved, cohesive, and better organized spaces that exhibit a more nuanced sense of place.

# Looking into the Future: Ten Year Review of Academic Job Openings in Landscape Architecture in US

**Taner R. Ozdil** The University of Texas at Arlington  
[tozdil@uta.edu](mailto:tozdil@uta.edu)

The purpose of this research is to review landscape architecture academic job openings from the past ten years to report on the changing trends in education and practice. The presentation focuses on the analysis and synthesis of over 410 full-time job descriptions in the US in order to highlight future trends as perceived by academics in landscape architecture. The research not only illustrates the evolving needs of landscape architectural academic institutions to educate future generations but also gives a snapshot of the state of landscape architecture in academia. The presentation also reports on the credentials required or preferred, specialized teaching and research subject areas desired, and the preparation that it may take to become an academic in landscape architecture. In particular, presentation allows a look at which areas of teaching, research, service and/or leadership were in greatest demand.

Between 2006 and 2016 over 410 (and counting) full-time academic job openings in landscape architecture were advertised, and collected for this research. The descriptions come from 69 accredited programs in the US (ASLA, 2015) and they were permanent openings for tenured or tenure-track, and/or leadership positions. The announcements are presumed to be crafted to seek the best possible scholars, educators, and/or administrators to teach, conduct research, and/or lead academic institutions in the coming decade(s) therefore they become the subject of the analysis. Although the announcements created previous research opportunities (CELA 2011, 2009; ECLAS 2010) ten years' worth of data promised a more comprehensive information to conduct content analysis this year. The research uses elemental analysis technique of counting word frequencies (Dym, 1985). Descriptive statistics are also adopted where they found appropriate. The themes that are emerged then recorded as findings.

The research reveals that there is a continuing interest in establishing a stronger knowledge base in landscape architecture within scholarly circles. There is a strong demand for candidates who are equipped with basic knowledge in core areas. The research suggests that our professional and scholarly interests have become more specialized especially in digital technologies, environmental issues, and sustainability while we have emerging interests in understanding the performance of landscapes over the years. Findings also show that there appears a shift in the desired professional and academic credentials within the past ten years. In conclusion, the research illustrates that the results can be used as indicators of trends among scholars and professionals to anticipate the challenges in landscape architecture in the coming decade.

# Pen and mouse: An evaluation of an on-line graphics course

**Benjamin George** Utah State University  
[benjamin.george@usu.edu](mailto:benjamin.george@usu.edu)

**Kris Kvarfordt** Utah State University  
[kkvarfordt@cachelandmark.com](mailto:kkvarfordt@cachelandmark.com)

**David Anderson** Utah State University  
[david.anderson@usu.edu](mailto:david.anderson@usu.edu)

Online education is increasingly important in higher education as universities seek to respond to changing financial realities and market pressure (Christensen & Eyring, 2011; Yuan & Powell, 2013). Additionally, innovations in communication and technology have made online education increasingly effective and enabled institutions to expand access to larger numbers of students irrespective of geography. Experimentation with distributed design education (online education in the design fields) has occurred for nearly three decades, but with conflicting results and inadequate assessment (George, 2014). This presentation describes the evaluation of an online basic graphics course at Utah State University. During implementation of the new course, an evaluation of the course was undertaken to determine its effectiveness in achieving learning goals and assessing the impact on student performance.

A comparative evaluation was used, wherein a random sample of students enrolled in the course were placed in a traditional face-to-face classroom, while the remaining students utilized the online curriculum. Student submissions were graded by three outside graders who evaluated the graphic quality of each submission. These submissions included black and white, as well as color graphics. Students were evaluated on the production of schematic, plan view, sectional, and perspective graphics. The scores provided by the outside graders were then compared using a repeated measures ANOVA to determine if any statistical difference existed between student performance in the face-to-face and online course.

The results of this study found that face-to-face students performed marginally better than online students, but the difference was not statistically significant. This finding was consistent across nearly all the projects, and was also reflected in the final course grades. However, when student time spent using the online course was considered, the performance gap was eliminated. It is hypothesized that these results can partially be explained through the lack of three social dynamics inadequately present in the online course. These three are a lack of immediacy of feedback, an inability to easily see the work of peers, and difficulty creating a learning community similar to that which exists within the studio space. Despite these shortcomings, students reported several benefits to the online course, including the ability to review course material from previous lectures, richer communication with the professor outside of scheduled class hours, and the flexibility of the course. While the results illustrate areas needing improvement, the overall evaluation suggests that graphics-heavy courses can successfully be delivered in an online format.

# Fieldwork: Definition, History, Ethics

**Phoebe Lickwar** University of Arkansas  
[plickwar@uark.edu](mailto:plickwar@uark.edu)

**Katya Crawford** University of New Mexico  
[katyac@unm.edu](mailto:katyac@unm.edu)

**Paula Horrigan** Cornell University  
[phh3@cornell.edu](mailto:phh3@cornell.edu)

**Thomas Oles** University of Edinburgh  
[T.Oles@ed.ac.uk](mailto:T.Oles@ed.ac.uk)

Every landscape design rests, ultimately, on fieldwork. The ability to sense, record, and evaluate phenomena in the world, and to derive normative inference from this experience, is thus among the most valuable skills that students of landscape architecture, whatever their other interests or aspirations, can master. The importance of fieldwork has endured even as the tools and methods of design have changed dramatically in recent years.

Yet if fieldwork is as important as ever to landscape architecture practice, it is less and less prominent in landscape architecture teaching. Students of landscape architecture today are under pressure to manage larger and more disparate bodies of information, and to attain ever-greater heights of technical proficiency. In this context there is little space—temporal or physical—left in the curriculum for learning old fieldwork methods, or inventing new ones. When taught at all, these methods are usually presented as though it is clear what fieldwork is and how designers should ‘use’ it. The product of this methodological vacuum are students with great technical skill but little design intuition, practiced at analyzing the world from the studio desk but increasingly reluctant to confront the world directly in all its messiness and agonism.

Panel conveners will engage the group in a collective debate of this apparent dilemma. The panel will present notable examples of fieldwork methods and invite participants to draw on their own knowledge and experience in the teaching and learning of landscape architecture to answer three kinds of questions:

**Definition.** What is fieldwork? Is fieldwork a single method, a set of methods, or a methodology? Does fieldwork differ, both cognitively and operationally, from other aspects of the design process, or is it integral to the design process itself?

**History.** What is the state of fieldwork in landscape architecture education today? What evidence points to its decline, and what evidence suggests its vitality or resurgence? How has the rise of digital technologies affected both fieldwork skills among students, and fieldwork teaching in the landscape architecture curriculum?

**Ethics.** Should instructors of landscape architecture teach fieldwork methods, fieldwork methodology, or both? What aspects of fieldwork continue to ‘matter’ in an age when one can gain knowledge about any place from any other place? What practical dilemmas does teaching fieldwork imply in professional programs today? What can landscape architecture learn from other ‘fieldwork disciplines’ such as geography, anthropology, and the natural sciences?

# Lawn and Order – Special Tree Victims Unit: A Seminar on Plant Establishment and Mortality

**Julie Stevens** Iowa State University

[jstevens@iastate.edu](mailto:jstevens@iastate.edu)

**Jeff Iles** Iowa State University

[iles@iastate.edu](mailto:iles@iastate.edu)

So called “managed landscapes” are a complex blend of plants, organic and mineral groundcovers, and hardscape materials. When properly designed, installed, and maintained, managed landscapes provide economic and quality-of-life benefits for people and the environment. But the journey from concept to finished landscape is often fraught with challenges, frustrations, misconceptions and ethical dilemmas leading to dead plants and undesirable landscapes. A major problem facing the profession and academia is the gap that exists between the designer’s intentions and the reality of implementation and maintenance. It is not uncommon for high rates of mortality among plants within a year of installation, with increasing mortality over time, resulting in the loss of millions of dollars in materials and unrealized values. There are many possible causes of mortality including: improper specification of plants, growing practices that lead to root girdling, installation in undersized planting areas and/or highly compacted soils, adverse environmental conditions, and inadequate maintenance.

However, we can create functional, sustainable, and beautiful landscapes when abiotic and biotic stress are alleviated via a continuum of practices that begin with thoughtful design and end with science-based installation and maintenance. To examine the problems of site design and plant mortality, the authors created a seminar in Plant Forensics. This course brought together students from two departments—Horticulture and Landscape Architecture—to examine the critical relationship between plant health and establishment and current design and installation practices. A major goal of the seminar was to use site investigations to spark discourse among students, faculty, and guest practitioners.

The course’s weekly format involved a 50-minute lecture/discussion and a three-hour site visit led by local designers, horticulturalists, contractors, facility maintenance personnel and nursery professionals. Students were expected to analyze and critique readings and presentations and develop their own understandings through independent projects, such as the “Forensic File” a semester-long compendium, in which students captured personal reflections and knowledge that the instructors hoped would be useful to their future professional careers.

That the seminar successfully activated participants’ concerns for plant health was evident in the passionate, class discussions. However, the instructors wonder how this course can have larger impacts. Can engaged dialogue with students and the academy help make changes to their practice? Will enlightened students influence their future employers? This presentation will reflect on these questions, discuss lessons learned and propose future ways of addressing plant mortality both in and out of the classroom.



# Continuing to reduce human-nature distinction in landscape education, impacts and implications

**Tracy Walker Moir-McClean** University of Tennessee  
[moirmccl@utk.edu](mailto:moirmccl@utk.edu)

The intent of the literature review presented is to determine if site analysis and planning textbooks used by Landscape Architecture educators still present human and natural realms as distinct and polar categories. If distinction is present, some examples of logical, ethical or philosophical frames that alter the organization of distinctions within these realms will be identified, and implications for revision of course materials for inventory, analysis, and design of landscapes discussed.

The following questions are considered: I. Is categorical differentiation between anthropogenic and natural systems still present in ecology-based design educational texts in the United States? II. If distinction is present, what examples might philosophical, ethical and historic literature of human-nature relationships offer to alter categorization and analysis of elements in the human and natural realms? III. How does altering categorical distinction between human and natural elements of landscape begin to impact or inform professional and educational practices for inventory, analysis, and design of landscapes?

Two Literature reviews are used to sequentially address the three questions listed above. Impacts of categorization on educational materials and design practices including strategies for inventory, analysis, and design of landscapes are discussed. Note that the literature reviews focus on literature applicable to professional practices in the United States and readily available in English.

## Review.1 Ecology-based Site Analysis, Design, Planning Texts 2000-2015

This survey focuses on content categorization in the table of contents, section and chapter headings in textbooks. (16) Site analysis, design and planning textbooks advocating a sustainable or ecologically-based approach are reviewed. Publications from Wiley, Island Press, Routledge, McGraw Hill and Taylor & Francis are included. Literature survey is complete and categorical differentiation between humanity and nature is still present in texts.

## Review.2 Philosophy, Ethics & History 1864-2015

This survey focuses on identification of examples for discussions mentioned above. Literature from ecological, social and cultural history-theory of man-nature relations and landscape alteration is reviewed. 1864 is selected as a start point because it is the year George Perkins Marsh's 'Human Responsibility for the Land' was published. In this text Marsh presents human agency as a major element in landscape change.

## FINDINGS & IMPORTANCE

This research contributes to a continuing didactic and ethical dialogue on the existing and potential influences, roles and participation of humanity in landscape systems and environments. Discussion is opened on the professional and educational implications of altering categorization of elements in landscape architecture inventory, analysis, and design practices. This research may also influence development and delivery of course materials and critique by educators interested in the topic.



# Ensuring Successful Team Work in Education and Practice

**Sadik Artunc** Mississippi State University  
[sa305@msstate.edu](mailto:sa305@msstate.edu)

Design does not take place in isolation. Landscape architects often work in disciplinary and/or interdisciplinary teams to provide professional services. The knowledge, skills and abilities gained in teamwork experience are relevant to the acquisition of skills across all university experiences. Effective communication and negotiation abilities, the capacity to identify, define and analyze problems (individually and in teams), personal and intellectual autonomy, a professional understanding of diversity, and the development of information literacy skills contribute to areas of proficiency in all disciplines. There are a number of learning and teaching, social and communication considerations for both faculty and students in organizing, facilitating, and evaluating team experiences so that students have educational and enjoyable experience in which they all contribute and be accountable.

This presentation will share various means and ways of organizing, facilitating, and assessing team work in an educational (and professional) setting. The presentation will cover:

- The current and emerging educational theory on team work from organization to assessment.
- Lessons learned from the experiences of the author in disciplinary (landscape architecture) and multi-disciplinary (architecture, graphic design, interior design, and landscape architecture) design studios over an extended period in several institutions of higher learning. Therefore, there were a great deal of diversity in project focus and educational departments (disciplinary to multi-disciplinary and eventually interdisciplinary), in project duration (one short-term to semester long, in level of students (single level studio vs. vertical studio and undergraduate vs. graduate students).
- Recommendations for organizing successful team work and experiences in educational settings based on the literature and the experiences cited above.
- Recommendations for organizing successful team work and experiences in educational settings so that students are effective and efficient in transfer of teamwork experience gained in educational setting and able to build on these experiences in the professional setting post-graduation.

The presentation will conclude with a Q&A session toward formulation of a research group on this topic.

# Exploring the Art and Science of Stream Restoration through Interdisciplinary Learning

**Jessica L. Canfield** Kansas State University

**Tim Keane** Kansas State University

Stream Restoration is a complex design challenge in which interdisciplinary collaboration and problem solving are requisite. In the classroom such a design challenge requires students to apply analyses strategies, problem-solving approaches, and knowledge from their separate disciplines toward a central issue. In doing so, students are able to make connections between their seemingly distinct professional domains as well (Ivanitskaya et. al, 2002). Interdisciplinary collaborations can also better prepare students for diverse practice experiences, by testing their communication skills and expanding their personal knowledge base (Goring, et al., 2014).

As a means to prepare landscape architecture and biological & agricultural engineering students for future practice in stream restoration, an advanced studio was offered at Kansas State University in fall 2014. The studio was structured in teams, simulating an office-like experience. To provide hands-on learning, while also helping inform campus planning efforts, the project focused on Campus Creek, a local highly degraded urban stream. Students were charged with collaboratively developing a design proposal that sought to stabilize the stream, increase flood storage capacity, restore native ecosystems, enhance campus circulation, create new amenities, and expand research opportunities. The complex nature of the problem required students to engage in an intense research and applied learning process. Working first at the watershed scale, students conducted hydrologic modeling and runoff calculations. Then at the site scale, they conducted a channel survey, bank stability and erosion potential analysis, a habitat assessment, water quality assessment, and soil inventory. Students also studied the stream corridor's aesthetics, existing design features, and user preferences. In developing a contextually appropriate design solution, students were forced to confront and reconcile differences in ecological needs and aesthetic demands.

Design outcomes (including technical reports, design development documents, digital renderings, and physical models) were presented to university administrators in the form of a summary book and public exhibition. As of August 2015 the most recent campus planning document now includes a dedicated greenspace zone called the Campus Creek Preserve. In this paper authors discuss their pedagogical approach; describe how they orchestrated various data collection activities and design production efforts; and illustrate outcomes from this interdisciplinary applied learning course.

# Assessing the Current Integration of Software in Landscape Architecture Curricula

**Peter Summerlin** Mississippi State University  
[ps111@msstate.edu](mailto:ps111@msstate.edu)

**Benjamin George** Utah State University  
[benjamin.george@usu.edu](mailto:benjamin.george@usu.edu)

**Charles Taze Fulford** Mississippi State University  
[Taze.Fulford@msstate.edu](mailto:Taze.Fulford@msstate.edu)

Digital representation remains fundamental to the current practice of Landscape Architecture. It is embedded in academic curricula, graduating from a single “computers” course in years past to currently permeating nearly all courses and design projects. New digital representation practices are not in competition with analog representation, rather these tools have formed a new paradigm – the hybrid representation workflow (Cantrell 48). In this paradigm, academics must make choices about which drafting, rendering, modeling and/or publishing software to integrate into curricula and to what degree these tools should be taught. This research sought to capture the current state of design software in Landscape Architecture curricula by disseminating surveys to all accredited BLA and MLA programs across the United States. The survey examines three major questions:

1. What specific software packages are departments, schools, and colleges teaching in their courses?
2. Do the curricula have a dedicated “computers” course or courses or do they integrate the digital software through workshops and labs in other courses?
3. How do current faculty negotiate students working across two unique operating systems (Windows and Macintosh OS)?

More than simply noting if a program is discussed, the survey sought to capture the depth to which each software package is covered in courses. This was executed through a Likert scale associated with each software package. This added texture to the survey provides a truer representation of software usage in accredited programs. Similarly, this process showcases which niche’ software packages have gained the most traction nationally and allows for speculation of future trends both regionally and nationally. Altogether, the findings provide a current snapshot of the state of design software in Landscape Architecture curricula across the United States.

# The Boundary Management Tool Box: Key Strategies for Building the Expertise of Emerging Landscape Researchers and Practitioners to Address Complex, Socially-Rooted Environmental Problems

**Laura R. Musacchio** University of Minnesota  
[musac003@umn.edu](mailto:musac003@umn.edu)

Boundary management, also known as boundary work, is emerging as an approach to better link the expertise divide between the two worlds of landscape research and practice when addressing complex, socially-rooted environmental problems. Managing the boundaries between academic research and professional application can be challenging for even the most seasoned landscape researchers and practitioners because of the demands to master two complementary knowledge and skill sets: (1) an expert-level grasp of a particular discipline and (2) an expert-level flexibility to connect across disciplinary boundaries. Emerging landscape researchers and practitioners can find it a key challenge to juggle these two types of expertise in their graduate education because of the steep learning curve for mastering both of them. Yet, they have to address the integration of academic research and professional application when tackling complex, socially environmental-rooted problems, which are the focus of their graduate studies like capstone projects, theses, and dissertations. This presentation explores this key challenge in three parts: (1) exploring the meaning of boundary management for these problems in landscape research and practice; (2) fleshing out the need for better boundary management tools to help build their expertise in addressing these types of problems; and (3) discussing a proposed boundary management tool box with three key strategies to enhance their expertise to integrate academic research to professional application. The key strategies in the boundary management tool box are: (1) identification of the major boundaries between academic research and professional application; (2) boundary management skills among cultures; and (3) horizon scanning skills to develop scenarios for plausible futures. The use of the boundary management toolbox in different types of graduate curriculum settings are considered including a workshop for graduate students in a course in a Master of Landscape Architecture program and an interdisciplinary workshop for graduate students and emerging professionals in the environmental disciplines (i.e., sciences, management, engineering, planning, policy and so on).

# Feeling Small in Large Classes: Investigating How Small Group Blended Learning Strategy can Decrease Feelings of Anonymity and Perceived Class Size

**David Spooner** University of Georgia

Research on class size preference suggests faculty and students express dissatisfaction towards large lecture classes when compared to smaller classes. A common criticism relates to the fact that large lecture classes have less student/faculty and student/student interaction and increased feelings of anonymity.

Common strategies to limit the negative effects of large classes center on incorporating teaching methodologies that make class size feel small. Personalization strategies, such as learning student names and increasing faculty accessibility are examples. Active learning strategies that increase classroom interaction are other recommended solutions.

Infusing active learning strategies into large lecture classes presents unique set of challenges due to increased student numbers and the complexity of implementation. However, new digital learning tools (e.g. eLearning Commons) allow active learning strategies - specifically small group learning - to become a viable option.

The purpose of this study is to examine the effectiveness of small group blended learning strategy in a large lecture setting to determine whether perceived anonymity and class size can be reduced through face-to-face and virtual group learning. Specific questions this study attempts to address are: Does group learning reduce feelings of anonymity in large lecture classes? Is face-to-face group learning more effective than virtual group learning? What are the benefits and drawbacks of incorporating a blended approach? What role does faculty play in directing and participating in a blended approach to maximize interaction?

The study, conducted over two years contains input from 187 undergraduate students. Questionnaire reply data and Likert scale responses were recorded to identify trends and collective opinion regarding small group learning and a blended approach. The results of the study show a clear indication that small group learning can reduce the feeling of anonymity between faculty/student and student/student cohorts. The results do not suggest face-to-face is more effective than virtual group learning. The benefits of a blended approach center on the ideas of accessibility, flexibility and variety of learning and the drawbacks are associated with time and technology. The role of the faculty centers on the ability to offer personal responses to individual groups.

# Inverted Tactics; A Negative Space Approach to Visualizing the Landscape

**Maria Debije Counts** Pennsylvania State University  
[mmd16@psu.edu](mailto:mmd16@psu.edu)

**Christopher Counts** Pennsylvania State University  
[cxc74@psu.edu](mailto:cxc74@psu.edu)

How can the visualization of negative space play a role in improving how students learn about landscape design? Is it possible for representation of inverted landscape spaces to point towards a new kind of spatial awareness in the 21st century? This paper and presentation seeks to define how the under-representation of human space has presented a predicament in design pedagogy. It also explores how a new approach to studying the volume of human space as a medium can impact and effectively engage students in defining and working towards a more nuanced understanding defining space as positive and negative, inverting the traditional perspective for exploring design visualization.

Analog, digital, and hybrid methods of representation, visualization and fabrication point toward a new approach to site design pedagogy emerged to equip students with new design tools for making informed decisions in shaping the elements embedded within design interventions. Testing and developing ways of engaging negative space that would otherwise have been invisible space is visualized and explored. Alternative realities ranging from simple to complex sites test new methods in digital fabrication with particular attention to the physicality of human occupiable space to promote an enhanced understanding and spatial awareness of the built and un-built environment.

The knowledge and representation of space as a medium is a critical facet to understanding the potential of space and composition inherent to any landscape, large or small. Negative space is human space is considered in the shaping of landscapes as it is this human space where volumes for creating environments emerge. An inverted approach to studying landscape architecture presents new opportunities for innovative experientially-based design solutions. A series of two and three-dimensional studies serve as the foundation for generating new knowledge and tactics in the study of spatiality in landscape architecture to lead to constructed compositions.

# Developing a Teaching Garden through Student Experiential Learning and Multidisciplinary Collaborative Scholarship

**Michael Holmes** Oklahoma State University

[michael.holmes@okstate.edu](mailto:michael.holmes@okstate.edu)

**Abstract:** A landscape architecture program located in a small rural town is challenged by the limited pallet of local professionally-designed landscapes to serve as teaching examples. The student base largely comes from similar rural communities where quality design is lacking. As a result, students without exposure to good design indiscriminately find inspiration from average- to poor-quality solutions with which they are familiar. This paper documents the development of a teaching garden as a tool for enhancing design awareness and experiential learning.

To provide additional teaching resources and design examples, landscape architecture faculty developed partnerships within the university, profession, and community to expand a small horticulture demonstration garden into a comprehensive botanic garden. Prior to expansion, the garden's primary academic use was for plant identification courses. While the garden successfully displayed ornamental plantings, it did not effectively demonstrate design or spatial principles and was a detriment to teaching landscape architecture.

Over a ten-year period, faculty provided leadership in strategic planning, design, and implementation on multidisciplinary projects to develop the botanic garden. Landscape architecture curriculum was integrated throughout the process with multiple design studios using the site to explore master planning, site design, and planting design. In many cases class projects helped guide implemented design solutions. Students in construction materials and methods classes participated in hands-on construction projects including design, grading, detailing, and installation of concrete paver walkways and plazas that established a circulation system for the garden. Another series of hands-on projects focused on wooden structures including arbors, trellises, fences, benches, and an outdoor classroom.

In addition to coursework, several landscape architecture students assisted faculty in development of the garden through independent studies, special projects, research assistants, and garden internships. Some projects involved students in community and professional interactions.

The botanic garden has transformed how landscape architecture faculty teaches the curriculum. Newly available experiential learning opportunities include: spatial patterns studies, design principles, surveying, irrigation, accessible design, material applications and construction techniques. Resources for teaching LID practices have enhanced student learning. Installations of pervious paving, bioretention, stream reclamation, constructed wetlands and rainwater harvesting have given students first-hand experience with topics recognized by ASLA as critical to the profession(1).

Research documents that experiential learning ensures longer retention, increased motivation, and a deeper understanding of subject matter than traditional lectures(2). In addition to student impacts, the botanic garden expands opportunities for extension and research programs and is enjoyed by over fifty thousand visitors annually.

# A Faculty Finds Itself by Process

**Todd Johnson** Utah State University

**Barty Warren-Kretzschmar** Utah State University

As a design and planning faculty do we use and teach a similar design process? What do we have in common and how do our processes differ? Is it even important that a faculty agree on a design/planning process? How do we acknowledge theory, design process and content that spans four decades in the chronological experience of a faculty? How can a conversation about design process yield understanding of the individual and shared objectives of a faculty? These questions are the focus of an investigation that addresses how a department can align its design process approach and, ultimately, become more cohesive while recognizing diversity within the faculty.

Within the profession of landscape architecture, many talented designers have articulated their process. As faculty members, we are a product of the legacy of their theories and contemporary discourse about the design process. For example, do we adhere to: a structured design process of analysis and creative synthesis (Sasaki 1950, Lynch 1962); or the ecological/rational method of Ian McHarg (1967); or a more intuitive, iterative process that emphasizes the collaborative nature of design (Halprin 1969, Hester 1974); or recent reactionary and non-rational theory (Corner, 1999) in our teaching approach? Each faculty member within a department has been shaped by different traditions, theories, and approaches. The composition of the faculty spans five decades of theoretical and pedagogical shift.

This presentation explores the design processes used by Landscape Architecture and Environmental Planning faculty members to discover the commonalities and differences in their approaches. The motivation for investigating design process approaches among the faculty is to initiate discussion about the importance of process in problem solving and in teaching. The greater goal is to explore common ground and differences in approaches to teaching planning and design competency via design process. Establishing a common language is the first step to identifying the unique process elements of different faculty members. This is not achieved without debate. A faculty that engages in a process discourse not only aligns its teaching approaches but offers students the opportunity to develop an awareness of their personal design process. The methodology for developing/identifying an aligned process within the LAEP department is discussed, as well as the outcome of the “process alignment”. This type of discourse among faculty is essential in building a cohesive curriculum and coordinated teaching approaches.



# Feedback as a Teaching Tool: Aligning feedback with successive stages of the design process

**Susan Tomizawa** Ball State University  
[satomizawa@bsu.edu](mailto:satomizawa@bsu.edu)

**Ann Hildner** Ball State University  
[ahildner@bsu.edu](mailto:ahildner@bsu.edu)

Feedback refers to “the process of evaluating and discussing” the performance of learners (Harms and Roebuck, 413). The methods and frequency of providing feedback vary, but are directed at making learners aware of strengths and weaknesses. Effective instructor feedback points to and explains a learner’s successful efforts as well as identifying areas to be improved upon, with an indication of how to make the needed improvements. The goal of providing feedback is to establish a continuous progression of learner improvement throughout the course of a project or studio class. Providing effective and timely feedback to students, however, can be challenging. In addition, receiving and reacting to feedback can sometimes be difficult for learners (Cleveland, Lim, and Murphy, 170). This paper presents an example of methods of feedback used in a 3rd-year planting design studio that respond to each phase of the design process. These methods have evolved in response to difficulties learners have in making consistent progress through the design process. Through observation of students and evaluation of student work, the instructors have found that with varied feedback, students better envision and revise design work.

As part of the feedback process, interim assignment deadlines are set. During early design conceptualization, when learners struggle to visualize and interpret instructor feedback, the manipulation of 3-d study models is effective in helping students envision spatial organization, scale, massing, lines, etc. As designs move toward completion, instructor written feedback is often used and is dependent upon students meeting intermittent deadlines. Upon project completion, peer reviews are included as feedback. Student response to these types of feedback, gathered in informal interviews and formal course evaluations, has been positive. Linking feedback to assessment has had mixed reviews from students, with some finding that it motivates them to stay on track through the design process, while others feel it adds an extra layer of pressure due.

Student attendance is critical throughout in order to meet the interim deadlines and receive the corresponding feedback. Instructors found that while students appreciate the frequent feedback, the instructors frequently had to repeat feedback, perhaps indicating that there is only so much feedback students will respond to at one time. There is a need to make sure that students become aware of what the feedback is and respond accordingly. Recommendations include having students write a reflection on the feedback they receive.

# Landscape Architecture Education Curricula: What Can We Learn From Each Other?

**Tanya Rice** Utah State University

[tanyakay1@gmail.com](mailto:tanyakay1@gmail.com)

**Carlos Licon** Utah State University

[carlos.licon@usu.edu](mailto:carlos.licon@usu.edu)

The purpose of this study is to comprehensively compare the curriculum content of United States accredited Landscape Architecture (LA) BLA programs. This paper will provide a panoramic view of the current state of LA education and articulate the degree of coherence and dispersion of educational content as represented in course offerings. It will then define the current trends and patterns of curricular content among the programs.

The Landscape Architectural Accreditation Board is the guiding force to content program design, addressing twelve areas of knowledge: History, theory, natural and cultural systems, plants and ecosystems, public policy, design, site planning, construction, communication, professional practice and ethics, and technology. LA programs across the United States adopt different curricular structures to address and expand these areas of knowledge. The current state of LA education is represented in how different programs tailor their educational offerings and strengthen selected areas of knowledge. A curriculum composition reflects the ideas and priorities identified by educators to respond to the demands of the discipline, their vision of the future, and their available material and human resources.

Different emphases, resources, and pedagogical approaches are reflected in the curriculum organization found in accredited programs. This study looks into all 44 accredited programs' course offerings to identify and classify coverage and emphases in their BLA education. The study organized more than 1,100 courses into 14 thematic categories based on LAAB stands and procedures to establish curricular composition. It describes each program by number of credits required for each of the 14 categories defined and looks into the proportional emphasis of each program. A comparison of programs by each area of knowledge provides a helpful inquiry to geographic trends, four-year versus five-year program contrasts, rankings, and many other trend and pattern discoveries.

Presenting a broad view of LA education, this work provides LA programs with a valuable benchmark for future curriculum revisions and a way to clarify focus and goals. It is also a first view into the current state of the LA education to inform discussions on how programs are responding to the accreditation board, as well as establishes a first collective image of what the course offerings and the credit load patterns show. Additional studies are required to understand the effectiveness and the impact of the current educational offerings.

# Mapping Curriculum Content Across a Landscape Architecture Program: Are We Teaching What We Think We Are Teaching?

**Michael Holmes** Oklahoma State University

**Cheryl Mihalko** Oklahoma State University

**Qing Lana Luo** Oklahoma State University

**Bo Zhang** Oklahoma State University

Section three of Landscape Architecture Accreditation Board's (LAAB) standards prescribes expectations for an accredited landscape architecture program's professional curriculum. These expectations require documentation of how the program's curriculum integrates eleven critical topic areas: 1) history, theory, and criticism; 2) natural and cultural systems; 3) public policy; 4) design planning and management; 5) site design and implementation; 6) construction documentation; 7) written, verbal, and visual communications; 8) professional practice; 9) professional values and ethics; 10) plants and ecosystems; and 11) computer applications and technologies(1).

Course content evolves from one year to the next in response to instructors' experiences and shifting trends within the profession. A course may be passed from one faculty member to another and content added, removed, or changed. As faculty focus their efforts on individual coursework, it is easy to lose sight of how the content relates to the overall curriculum objectives.

In an attempt for faculty to better assess overall program curriculum and how content related to LAAB standards, the teaching faculty mapped the eleven critical topic areas across all required courses. Initial data collection (fall 2014) examined the faculty's perceptions of content delivered in all courses, including courses that other faculty are responsible for teaching. This process identified topical areas that potentially receive less emphasize and those that were perceived to be heavily integrated across the program's curriculum. This initial data, when compared to supplemental data, helped faculty improve program-assessment skills.

Additional data collection (spring and fall, 2015) provided an understanding of weekly and overall course content delivery. For each required course in the landscape architecture curriculum, faculty rated the degree to which they included each of the eleven topical areas in their individual courses. For each topical area, faculty indicated if weekly content had primary, secondary, or no inclusion of the subject. In all, twenty of the twenty-two required courses were assessed.

Data analysis identified topical areas that are currently prioritized over others. The curriculum map provided an opportunity to visualize relationships between lecture-based courses and the studio sequence. This provided insight into course and curriculum sequencing, such as which courses reinforced topics delivered in previous classes. Synergies in critical topic areas were revealed as they related course content delivery. Results also identify missed opportunities for content reinforcement across course types (studio, lecture, and lab) and through the 5-year course sequence. Data provided a quantitative framework for curriculum planning.

Comparisons between perceived curriculum delivery and documented curriculum delivery helped faculty identify their capacity for self-assessment and determine the frequency which formal assessments need to be conducted.

# Design Week In Motion: Applying App Based Data Collection & Assessment in a Department-wide Studio Design Charrette

**Christopher J. Seeger** Iowa State University

**Ryan Hargrove** University of Kentucky,

**Carolina Segura** University of Kentucky,

This paper presents a unique method of applying app based data collection and assessment methods to a department-wide semester kickoff studio experience at the University of Kentucky Landscape Architecture Department during *Design Week 2015*. Developed as a charrette-style event to serve multiple purposes, the primary objectives of Design Week are to contribute to the academic experience of future professionals, to develop long-term relationships with academia that may lead to research relationships, and to enrich the professional development of participating staff. An additional benefit of charrette-style teaching was that it provided joint problem solving and creative thinking in an intense setting. The accelerated timeframe facilitated fast and interactive decision-making and provided a rapid cycle of feedback.

The 2015 Design Week studio project “in Motion” was developed to kickoff the new school year while tackling transportation issues resulting from rapid growth of and around the University of Kentucky campus in Lexington. Utilizing a university and industry collaborative known as Design Week, approximately 85 students and faculty from programs in Landscape Architecture and Interior Design spent nine intense days researching and developing design proposals for improved walking and bikeability. A significant component of this project was a partnership with Iowa State University Extension and Outreach to share their expertise in the use of smartphones and geospatial Apps to collect and assess landscape infrastructure and then visualize and analyze the data using open-source and traditional GIS mapping processes.

The weeklong vertical studio charrette provided an opportunity for students to take on a series of personas as they walked and biked between points identified as part of one of eight scenarios developed to mimic typical daily activities of a student. In addition to crowd-sourcing these routes, students also collected observations of aesthetic, comfort, safety or wayfinding issues along the routes and documented these locations spatially and with photos using their smartphones. This technology allowed the students to quickly develop a shared composite overlay map identifying key areas of concern to be addressed in the design process.

This paper documents the process used and shares examples of the materials produced during Design Week and during a studio project that utilized the design week outcomes.

Conference participants and readers will learn about the technologies used by students to collect and review the data, identify strengths and weaknesses of the technologies and learn how they might integrate the process into their next studio or outreach project.

# Assessing Learning Outcomes Using Cyclical, Scaffolded Student Reflections in Landscape Architecture Courses

**Bambi Yost** Iowa State University

[byost@iastate.edu](mailto:byost@iastate.edu)

**Leila Tolderlund** University of Colorado

[leila.tolderlund@ucdenver.edu](mailto:leila.tolderlund@ucdenver.edu)

**Jon Hunt** Kansas State University

[jdhunt@k-state.edu](mailto:jdhunt@k-state.edu)

In this panel, landscape architecture professors teaching a variety of courses at three different Universities will showcase how they teach, analyze, and assess learning outcomes using cyclical, scaffolded student reflections in combination with other class products. These self-reflective writing exercises build upon one another (scaffolding) and require looking back on previous writings/works (cyclical) to build mastery of self-discovery while making and learning. Specific examples from these three courses will provide: (1) teaching tools grounded on reflective and experiential learning through writing and making, (2) preliminary analysis of student journals/sketchbooks/videos for pedagogical reflective learning research, and (3) ways to evaluate learning outcomes using cyclical, scaffolded reflections.

One course is geared towards the beginning landscape architecture student with an emphasis on drawing, seeing, observing, and reflecting on continuous journaling and sketching. A second mid-level course combines cyclical, scaffolded reflections with an emphasis on personal growth and team collaboration using analog and digital methods to document progress and learning outcomes. The third advanced, transdisciplinary graduate-level course emphasizes the benefits of learning how one learns and how one designs using 2D diagrams, 3D models, and cyclical reflections to generate innovative incremental and combination design options.

Although these courses, final products, and learning objectives are very different, reflective teaching methods are based on the same premise that scaffolded, reflective thinking and learning enhances long-term memory, increases risk-taking, improves communication skills, and helps students focus on successes rather than failures. Preliminary analysis of students' reflections indicate that although many students find cyclical reflections time-consuming and difficult initially, by the end of the course, or even a year or two later, students truly come to value the benefits of documenting their design thinking processes and reflecting upon their growth as designers.

Faculty benefit from cyclical, scaffolded reflective practices as well. These final reflections are useful for evaluating less tangible student learning outcomes such as intrinsic motivation, enhanced design-thinking skills, and more open communication with students. In addition, students provide reflective self-assessments which greatly add to formal evaluation of students' progress, process, and final products.

# The Roadscape Project

**Heidi Hohmann** Iowa State University  
[hhohmann@iastate.edu](mailto:hhohmann@iastate.edu)

**Michael Martin** Iowa State University  
[mdmartin@iastate.edu](mailto:mdmartin@iastate.edu)

This paper reports on the outcomes and assessment of an innovative project devised for a learning community-based (Samaras et al 2008) traveling study program for beginning-level landscape architecture undergraduates. Teaching and learning on the road (as distinct from studio- and classroom-based pedagogies) presents particular opportunities (Edwards 2011; Salama 2007) and invites adaptation to the highly varied and constantly changing environment (Jackson 1980) through which the students and faculty move for six weeks of the semester.

Currently, the program features two three-week driving excursions during the sixteen-week semester for students entering the program, covering a total of about seven thousand miles and involving field study of a broad range of landscapes throughout a diversity of regions. An earlier study (Stevens and Martin, 2014) suggests that the Savanna experience gives students of Landscape Architecture (as compared with students in other design disciplines) a distinct advantage in field-assessment abilities and prepares them well for travel experiences they encounter later on in the degree program. These experiences have important implications for other design programs that are interested in learning communities or travel-based experiential learning pedagogies, and the Roadscape project developed this past fall is a promising pedagogical innovation.

The Roadscape Project was designed to take advantage of the generous breadth of landscape that the students encounter. About 40 days on the road translates to at least 40 unique places; at each stop or "landing" (Giro, 1999), the students break into teams that assess the landscape in some particular dimension. These include teams that account for GPS/location data; draw annotated site plans; record materiality; account for vegetation/biotic resources; record site phenomenology; photograph views and viewsheds; record social conditions through observation, behavioral trace recording, and interviews; draw cross-sections; draw perspective sketches; collect "found" materials.

Students switch teams periodically in order to develop expertise in a variety of site assessments. The project is effectively "crowd-sourced", since teams upload recorded information to "cloud" folders, accessible by everyone. Near the end of the term, each student is assigned one particular site as their unique place for a site intervention. Not only does each student engage a unique place; each student also makes use of site assessment materials developed by every other member of the class.

Results from the initial run of the project indicate that the students develop a range of abilities simultaneously: cooperative group work, site assessment/place responsiveness, and effective utilization of digital and analog mapping.

# The Role of Self-Regulated Learning in Design Pedagogy

**Matthew Powers** Clemson University

Designing, as well as learning how to design, involves as John Dewey (1938) says, the controlled or directed transformation of an indeterminate situation into one that is determinate. In Dewey's view, this process is essentially problem solving. Consequently, the most common approach to teaching design today is rooted in problem-based learning. According to Savery and Duffy (1995), effective problem-based learning depends on four key elements including authentic learning environments, relevant and meaningful projects, teachers that serve as facilitators, and most importantly, students who actively participate in their own learning through self-regulated thinking and behavior. This study focuses on this last aspect of problem-based learning – self-regulated learning.

Self-regulated learning is an important educational concept and predictor of academic achievement. According to Paris and Paris (2001), "Self-regulated learning, as the three words imply, emphasizes autonomy and control by the individual who monitors, directs, and regulates actions toward goals of information acquisition, expanding expertise, and self-improvement (pg. 89). Over 40 years of research has shown the importance of self-regulated learning as a significant factor in learning and achievement. However, few studies have examined self-regulated learning in design pedagogy. Thus, the purpose of this study is to explore the relationship between self-regulated learning and design teaching in landscape architecture.

The study's central research questions include: (1) what types of teaching methods and activities do landscape architecture design educators typically use in studios, and (2) how do these pedagogic methods accommodate, encourage, and discourage self-regulated learning? To answer these questions, the study uses data from a national survey of landscape architecture faculty members. Various statistical measures as well as content analysis were used to analyze the data. The result is a new conceptual framework for understanding self-regulated learning as a key factor in design teaching and learning.

The study's findings suggest that many design educators utilize teaching methods counterproductive to self-regulation. In fact, findings suggest that the pedagogic framework most commonly used in landscape architecture studios may need significant rethinking in order to optimize learning and achievement. To address this issue, the study provides a new way of thinking about design pedagogy called self-regulated design learning. Self-regulated design learning adjusts the studio environmental and project to encourage self-regulation, which in turn boosts learning and performance.

# Design and education of Landscape Architecture's Curriculum in the University of Dammam

**Ali Omar M. Al-Sulbi** The University of Dammam

[aalsulbi@uod.edu.sa](mailto:aalsulbi@uod.edu.sa)

Landscape Architecture Department has established at the University of Dammam (UoD) as a supporting department in 1975. It offered necessary courses in the fields of site planning, site analysis, urban design and plant materials for the students of the college of Architecture and Planning, who were graduated as architects with special emphasis in either Landscape Architecture or Urban Planning. In 1985, the department has become one of the college's academic departments and has started offering Degree of Master in Landscape Architecture (MLA). Eight years later, the Bachelor Degree program has initiated to overcome the gap of the country's requirements for professionals in landscape architecture.

Since 2001, the program has gone through continuous reviews. The recent has started in 2010 and revealed the adoption of new approach for education of landscape architecture in the Kingdom of Saudi Arabia (KSA). It has been developed to build basic knowledge in a vertically accumulated approach through theoretical courses on various topics of Landscape Architecture (LA) according to the emphasis of each Design Studio, and these knowledge carries out to the next stage with other theory and design emphasis. Supporting courses and built up knowledge are applied to a problem-solving design project of special emphasis in each semester.

This Study explores the curriculum design of LA at the UoD and the way of educating it in order to graduate fully skilled professional landscape Architects who are able to design, implement and manage landscape projects that vary in scales and contexts.



# Minecraft in Design Learning

**Eric Castle** University of Minnesota Crookston  
[castl047@umn.edu](mailto:castl047@umn.edu)

This study explores the application of the computer game Minecraft to teach spatial relationship and programming within a design framework. Minecraft is an open format computer based game set in a world composed of modular building elements. The virtual world within the game can be manipulated by users in an infinite amount of ways. The modular, collaborative and immersive nature of the game has potential for spatial learning in the design professions.

Minecraft was used to teach spatial relationships and programming during a 2 hour summer camp workshop for students ages 8-10. A Minecraft “world” was created that contained a neighborhood consisting of a number of residential scale homes. Each home had a fictitious homeowner living in the home. Student teams were then provided a list of design opportunities and constraints as identified by the home owner. These opportunities and constraints largely focused on views and privacy. Teams then worked to manipulate the surroundings around each residential unit in ways that met the client and site needs.

Findings included that the three dimensional immersive nature of the game world provided a visually tangible method for students to understand site opportunities and constraints and apply appropriate solutions. Assessment of learning occurred in two ways, (1) a critique of the final design solutions and (2) during oral presentations of final design solutions where participants demonstrated how their solutions achieved the spatial needs of the client. Prior familiarity with the game was helpful, but the relative simplicity of the game made it easy for non-Minecraft players to very quickly learn the basics of the game. This simplicity allowed students to think about then apply client needs in a spatial manner. This study also found limitations to this method. Instructor preparation and planning to facilitate the use of Minecraft in the classroom is significant. Familiarity not only with the nature of the game was necessary, but also familiarity with server and network requirements to create and host the virtual world was essential to successful implementation in the classroom. Due to the course graphics of the program, the design solutions would not be appropriate for use in a professional setting.

Continual improvement of teaching design principals, specifically spatial relationships, is essential to prepare emerging designers. Exploration of emerging technological techniques and methods should be engaged in to leverage the opportunities they may hold.

# AN INSTRUCTIONAL MODULE ON PERMACULTURE DESIGN THEORY FOR LANDSCAPE ARCHITECTURE STUDENTS

**Keni Althouse** Utah State University  
[kenialthouse@gmail.com](mailto:kenialthouse@gmail.com)

**Phillip S. Waite** Utah State University  
[ps.waite@usu.edu](mailto:ps.waite@usu.edu)

Permaculture is a creative design process based on whole-systems thinking. It guides designers to mimic patterns and relationships found in nature. Permaculture can be applied to all aspects of human habitation, from agriculture to ecological building, technology to education (Holmgren, 2002). Permaculture design principles (PDP) have the ability to help landscape architects design using closed system practices as well as restore food systems back into communities, utilize and save water efficiently, and restore vegetative and natural systems. Questions such as, “how can landscape architects design regenerative systems” and “how can landscape architects include PDP’s into future projects?” helped guide the purpose of this study of developing and delivering an instructional module on permaculture design theory for landscape architecture students.

An analysis of 23 Universities in the United States with an accredited landscape architecture program revealed only four offering courses in permaculture theory and design principles. Of these, none are taught within the landscape architecture department, nor require students to take the course for graduation. Landscape architects often learn within course work about ecological planning, urban agriculture, and landscape systems, however, PDP’s offer a unique package of tying everything together into one cohesive theory. Every time humans interact with the land – whether to solve a problem, to move between places, or to build – there is an opportunity for landscape architects to become involved and assist in producing a positive outcome (Foster, 2009).

An instructional module was delivered during fall 2014 semester at Utah State University that taught basic principles of permaculture theory. A studio project followed the module giving students opportunity to apply learned principles. Based on student and peer feedback, modifications were made and a second instructional module was delivered in fall 2015. In order to compare both years, the same material was taught and the same studio problem statement was employed; the only difference was the organization of the information given during lectures. During fall 2015, permaculture principles were likened to the design process, placing no more than three principles within each step of the process.

Questions from a post-module survey were coded in order to measure teaching effectiveness, student attitude and opinion of the instructional module. Student projects were evaluated individually to rate effective use of learned permaculture principles. Projects from 2014 were also compared and measured against those of 2015 to find how the organization of lecture material was received by students and their ability to produce a design using permaculture principles.

Foster (2009) emphasizes the importance of stewardship of the environment and understanding of natural resources to become a successful landscape architect. PDP’s aid in the process of understanding natural resources, which is why it is so important for landscape architects to understand the importance of permaculture design theory.

# Cross-Cultural Participatory Design Methods and Techniques across Differing International Political Contexts

**Robert Hewitt** Clemson University

[hewitt@clemson.edu](mailto:hewitt@clemson.edu)

**Hala Nassar** Clemson University

[hnassar@clemson.edu](mailto:hnassar@clemson.edu)

While demand for participatory design within democratic cultures remains significant over the last four decades (Linn 1968, Alinsky 1971, Friedmann 1973, Hester 1990, Sanoff 2000), effective methods for contemporary cross-cultural international design between democratic and more authoritarian cultures remain elusive. Consistent with recent CELA Conference debate about participatory techniques and their contexts (Hester, Hou, et al 2015), this paper extends that discourse into contexts of cross-cultural political orientation with the objective describing transactive design techniques for landscape architects.

The paper draws on research related to student educational experience in collaborative urban design studios between American and Egyptian Universities (Hewitt and Nassar, 2010). The studios addressed urban design projects of relatively similar scope and scale, combining American landscape architecture students and Egyptian architecture students. The students were surveyed with identical instruments at the end of the analysis phase, the master plan phase and at the conclusion of the each studio. Collaborative studio methods and techniques addressing decision-making and shared form-development were recorded. Attention was paid to the collaborative transactions between student designers and the constituent community members within their respective Egyptian political contexts.

Comparative statistical analysis from the surveys and method/technique observation suggest great similarities in experience and understanding between the two groups of students despite the differences in political systems and attendant degrees of citizen participation. Both student groups while operating in Egypt to some degree serve as proxies for citizens: reporting citizen opinion and incorporating citizen decision-making and form development. Decision-making techniques at analysis phase offer unique methods and techniques. The paper describes those techniques in detail including environmental and behavioral trace techniques indicating citizen form-making preferences.

# Interdisciplinary Student Design Teams: Managing Turbulence, Building Momentum, and Fostering a Culture of Organizational Creativity

**Eric Bardenhagen** Texas A&M University  
[bardenhagen@tamu.edu](mailto:bardenhagen@tamu.edu)

**Jeremy Merrill** Texas A&M University  
[JMerrill42@tamu.edu](mailto:JMerrill42@tamu.edu)

**Michael O'Brien** Texas A&M University  
[mobrien@arch.tamu.edu](mailto:mobrien@arch.tamu.edu)

Collaboration between design disciplines has long been a desired goal of many academic design programs as a means of broadening student experiences and simulating future design career practices. In reality, however, combined with differing curriculum requirements and scheduling conflicts, students in these multiple disciplines often are unprepared for, or have unrealistic expectations of truly collaborative team relationships. Similarly, design studio instructors often place a great emphasis on how combining disciplines can spur innovation or more holistic design concepts without understanding the underlying principles of small group development that can support or thwart creativity and productivity.

This paper explores many areas of literature related to small group interactions including psychology, business, sociology, anthropology and leadership studies. This begins with a discussion of the approaches that students often enter team relationships with, including the models that they may be carrying from previous classes or their early academic careers. Then, Tuckman's (1965) "forming, storming, norming, performing, adjourning" model offers a framework for explaining organizational behavior patterns within teams. Next the concept of organizational creativity discussed to better understand the process of cultivating creativity within the scope of interdisciplinary studio courses. And lastly, the concept of social sticky spaces offers a way to understand/visualize creating spatial and social nodes where ideas and methodologies collide, resulting in deep learning experiences and innovative form making.

The aim of this paper is to provide a means of incorporating this broad knowledge base of human interactions in groups from across many disciplines into a framework that meets the needs of the design studio. Further, an early version of an assessment tool is described that can allow studio instructors to periodically and systematically check the "health" of team relationships and their ability to draw upon each other's skills to innovate and maintain productivity. Examples from two interdisciplinary studio class projects involving undergraduate landscape architecture and graduate architecture students are used to illustrate these team processes.

# Four Years Or Five Years? Discussions on the Recent Movement of Several Undergraduate Landscape Architecture Programs from Five to Four Years in the United States

**Ming-Han Li** Texas A&M University

**Judith Wasserman** University of Georgia

**Ned Crankshaw** University of Kentucky

**Kim Douglas** Philadelphia University

**Robert Hewitt** Clemson University

**Kristopher Pritchard** Landscape Architectural Accreditation Board

Within the past one to two years, several undergraduate landscape architecture programs in the United States shortened the time to receiving a bachelor's degree from five to four (Williams, 2015). Although a few programs did this for other reasons, this movement was primarily a response to the pressure from the higher administration in most universities. Such pressure, to a great extent, came from a similar mandated requirement in most programs' respective state, that is, a college degree shall be completed in four years at 120 credit hours. This trend can be attributed to the 2008-09 economic downturn that triggered the demand for greater accountability and efficiency on higher education. Although exemption can be sought to continue a five-year undergraduate curriculum, current five-year programs are facing greater challenges specifically on student recruitment. This panel will include program representatives from those recently converted programs to discuss the following issues:

- How to maintain educational quality while the time is shortened and credit hours are reduced?
- How to include high-impact educational experiences such as internship and study abroad?
- Will accreditation be affected?
- Is the field's terminal degree leaning towards the master's?
- What are the major losses and gains before and after the conversion?

Panelists plan to include a brief interactive session with the audience and collect the information for later dissemination to those who are interested in further information.

# TopoGRAFT: Physical and Digital Modeling as Iterative, Reflexive, Generative

**Valerie Friedmann** Auburn University.

This presentation outlines student outcomes of a four-week studio project developed to familiarize first-year students with material model building and digital modeling and fabrication tools (Rhino, 123D Catch, 123D Make, CNC mill, and a laser cutter.) Engaging students with the direct experience of materials through physical modeling and digital fabrication while encouraging iterative, reflexive, and generative methods was key to the success of the project. The fast-paced project schedule prevented students from becoming “stuck” or overwhelmed with the often-daunting task of learning modeling software.

The studio began with a two-week *Materials Explorations* assignment. Students worked with plaster and modifying words, such as undulating, folded, or porous, that counterintuitively describe the conventional characteristics of plaster. Students began the material explorations with a period of loose experimentation and an attitude of *work as serious play*. As such, their modeling methods included scaffolding, fabric-forming, and balloons, clay, or foam insertions that were later removed or dissolved from the dry plaster. Students developed a critical approach toward craft and practiced making as a form of inquiry and discovery. Through a series of feedback sessions and revisions, students created numerous study models and a final plaster model that served as the springboard for the second project.

In the second project, *Digital Explorations*, students explored the design potential of capturing, redrawing, and remixing material properties of the plaster model in a digital environment. Students used 123D Catch software to create digital models of the plaster model. This provided students with a digital model, albeit an unsophisticated one, with which to gain familiarity with workflow, the Rhino interface, and fabrication tools. Next, students learned the basics of surface modeling in Rhino by drawing and fabricating simplified versions of the previous model. Finally, students combined the initial digital model with the redrawn model to create a hybrid, remix model that merged textural qualities of the first model with smoother surfaces of the redrawn model. Students combined knowledge of digital fabrication and plaster molding to build physical mixed-media final models.

The first step of the Digital Explorations project produced somewhat unusable digital models, yet proved critical in achieving overall learning objectives. This step removed the need for students to immediately begin drawing in an unfamiliar digital environment in order to create producible models over which they felt ownership. Once students completed their first digitally fabricated model they gained basic competency, confidence, and motivation needed to continue excelling with digital tools.

# Landscape Architecture and Allied Professions : Creating the Appropriate Multidisciplinary Teams in Higher Education

**Robert Dalton** Michigan State University

**Pat Crawford** Michigan State University

**Christina Dejong** Michigan State University

With each discipline comes an epistemology and practice (Bauer, 1990), uniting to form the organization's unique culture (Jurin, et al., 2010). Scope escalation and budget constraints require practitioners to unify these cultures and work collaboratively (Forbes and Ahmed, 2010). As such, educators must provide students with opportunities for multidisciplinary collaboration. Entry-level students will likely function in a dualist mentality (Perry, 1981). The results of this study demonstrate how multidisciplinary collaboration may aid student transitions into a relativist or a commitment epistemology, which is needed in practice. Utilizing Perry's Scheme as framework, this study proposes the key majors with whom Landscape Architecture students could partner depending upon one's evolving epistemology.

The research team designed and conducted twenty-five interviews around the world and among the built environment disciplines to gather information on each profession's culture. One question asked the interviewees to list the professions with whom they frequently practice. An international survey of 800 built environment professionals permitted the respondents to rate how frequently they collaborate with the listed professions.

A factor analysis of the responses demonstrated three key families of allied professions in the built environment: (1) outdoor spaces, (2) building and indoor spaces and (3) legal and real estate. Landscape architects quantitatively cluster into the first factor with urban planners, ecologists, civil engineers and others. Advanced statistical analysis shows that Landscape Architects collaborate significantly with key allied professions throughout the built environment.

A visual depiction of these relationships shows that landscape architects practice in a fairly balanced manner among the three families. The advantages and disadvantages of working closely with those in the same factor or creating student teams representing all three factors are explored. Those practicing for the first time in a multidisciplinary team may not have achieved the cognitive levels to process information and act accordingly in the interdisciplinary or transdisciplinary realms (Perry, 1981). A role of educators is to help students to develop growth-oriented minds (Dweck, 2006) for the ever-changing practice realm in Landscape Architecture. Such integration is most successful with cultural collaboration and idea exchange with professionals, administration, faculty, and students (Glasser, 2000).

## DESIGN IMPLEMENTATION





# Design Assessment for Sustainable Hydrologic System Development using a Systematic Framework

**Wonmin Sohn** Texas A&M University

**Jun-Hyun Kim** Texas A&M University

**Galen Newman** Texas A&M University

Evaluating low impact development (LID) applications has been paid attention as a new challenge to quantify the value of design projects. The main purpose of this research is to objectively assess the ecological, hydrological, and economic values of a LID project using a systematic design assessment framework. The project site was located on the main campus of Texas A&M University, College Station, Texas. The site was confronting a critical water challenge; frequently overflowed by runoff during rainfall events and reduced groundwater recharge due to severe drought in Texas. Polluted runoff from the parking lot located at the highest point directly traveled through the road without treatment process. Although the pervious areas covered more than 54% of the two-acre design site, rainfall on the existing building structure was straightforwardly discharged to the road, shortening the travel time of stormwater runoff and increasing peak discharge rate up to 7.22 ft<sup>3</sup>/s during extreme storm events. The gentle and flat topography on clay types also resulted in drainage problems and created standing water on surface near around the project site.

In response to these challenges, this project proposed the application of thirteen LID techniques on the site. To measure the value of proposed design, a systematical design assessment framework was applied. The framework focused on that LID facilities consequently modified water flow path in three tiered processes: capture, convey and clean (treat). Using assessment toolkits adopted by Landscape Architecture Foundation (LAF) and previous researches, five variables were measured in accordance with the framework. They included rainwater collection and reuse, runoff reduction, water demand reduction, stormwater quality improvement, and cost savings. Water infiltration ratios of applied LID facilities were also calculated based on datasets including monthly rainfall depth, evapotranspiration rate, plant coefficients, and post-design runoff coefficients.

The results showed that the proposed design could annually reduce 426,000 gallons of runoff (32.3%) compared to the conventional design. The plan was designed to capture 242,000 gallons/year of rainwater to reuse for outdoor irrigation. By employing LID on the entire 5,200-acre Texas A&M campus, this could save 2 million dollars of the annual cost of city water supply and stormwater runoff treatment.

This study will fill the existing gap between practical and scholarly efforts by providing a useful tool of a design assessment framework to measure and/or simulate the value of LID practices on design projects.

# Bioretention design parameters as predictors of pollutant removal efficiency—a data driven approach

**Runzi Wang** Texas A&M University  
[archizz@tamu.edu](mailto:archizz@tamu.edu)

**Ming-Han Li** Texas A&M University  
[minghan@tamu.edu](mailto:minghan@tamu.edu)

Bioretention best management practice (BMP) has gained recognition in landscape design because of its potential in reducing flooding and improving stormwater quality. Based on bioretention design manuals, many laboratory and field experiments have been conducted to explore how bioretention designs influence pollutant removal efficiency. However, conclusions of these experiments are not always convergent. Thus, research on bioretention performance is needed to improve our understandings of design parameters and how they affect pollutant removal performance.

The purpose of this study is to use published data to create a model in predicting bioretention pollutant removal performance with its design parameters. With information and data extracted from 51 publications, we compiled bioretention design parameters and corresponding pollutant removal efficiencies. 120 records were collected, including 54 records from field experiments and 66 from laboratory experiments. Key design parameters include the ratio of bioretention surface area to the contributing drainage area, filtration media depth, the presence of mulch layer, internal water storage (IWS) layer and organic matter. Water quality data include influent concentration, effluent concentration, and removal efficiency based on concentration and mass. Pollutants of total suspended solid (TSS), heavy metals, and nutrients are included.

From descriptive statistics of different pollutants, we found that overall pollutant removal performance of TSS and heavy metal are fairly stable and consistent. However, pollutant removal performance of nutrients varies greatly, which is mostly contributed by leaching of nutrient from soil. We conducted single regression analyses to predict pollutant removal efficiency with each design parameter. Multiple linear regression models are then constructed with the significant parameters obtained from single regression models to obtain the preliminary results:

Total nitrogen (TN) removal can be predicted with media depth, the presence of mulch layer, IWS and organic matter. The most significant positive design parameter is the presence of IWS. Media depth, the presence of mulch layer and organic matter all have a negative impact on TN removal performance because of leaching of nitrogen from soil. Total phosphorous removal can be predicted with the ratio of BMP surface area to drainage area, media depth and the presence of mulch where media depth and the presence of mulch have a negative impact. Heavy metal removal can be predicted using media depth in field experiments and lab experiments separately. For TSS, we could not reach a conclusion with confidence and the possible significant parameters are the presence of IWS and mulch.

# Innovative Living Systems - growing green infrastructure in the semi-arid and arid West

**Leila Tolderlund** University of Colorado Denver

[leila.tolderlund@ucdenver.edu](mailto:leila.tolderlund@ucdenver.edu)

Landscape architecture is increasingly facilitating integrated system discussions and enhancements in the field of innovative construction methods and materials. Advancing an understanding of trans-disciplinary academic-professional benefits associated with studying combined integrated nature and technology systems can help facilitate a more successful discussion for improvement of green technologies across disciplines.

By investigating green infrastructure practices over the past decade in the semi-arid and arid West, three issues arise: (1) standards for local best management practices (BMP's) are minimal or non-existent, (2) green infrastructure projects approach, and innovative design thinking is limited and not informed across disciplines, and (3) green infrastructure project more than often disregard the importance of fitting / splicing the 'green' and the 'infrastructure', and are as a result less successful.

This presentation will showcase new innovative design thinking, prototyping and construction in green technology materials and methods; it will demonstrate development of new standards and best management practices (BMPs) for green roofs and green walls; and exhibits new ways to approach green technologies by thoughtfully and intimately combining nature and technology (such as the mutual benefits associated with combining green roofs and solar pv panels; and bio-receptivity and innovative re-forming of otherwise very traditional urban surfaces, based on optimization of plant growth). Methods for collecting data include questionnaires, interviews, and observation techniques for cross-disciplinary green infrastructure design, implementation, and maintenance.

This presentation will furthermore examine the challenges and lessons learned associated with having everyone come to the table to discover a new understanding of the way nature and technology can work together. How design guidelines, BMPs, modeling, prototyping, testing and building new green technologies has helped inform the discussion between landscape architecture educators, accredited green roof experts, and landscape architecture professionals, will be shared.

By examining and showcasing student work in combination with feedback from experts in the field, products created to date with students and green roof accredited professionals, including green roof design guidelines, maintenance manual, and case studies for master planning, documentation, and implementation of green roofs and integrated living systems in arid- and semi-arid climates, alternative frameworks are suggested for growing successful green infrastructure projects based on local conditions.

New green technologies might hold the greatest potential in recent history for how landscape architecture leadership can position and shape the future of the profession.

# Ecological Patterns of Performance – Breathing Walls.

**Leila Tolderlund** University of Colorado Denver  
[leila.tolderlund@ucdenver.edu](mailto:leila.tolderlund@ucdenver.edu)

This presentation features a series of hybrid living walls – also referred to as ‘breathing walls’, indicating a performing, living and breathing system, created to optimize ecological performance through combining innovative materials + new patterns and forms. These include:

**B. Hotel** - a hybrid ‘living’ wall system that challenges the way we currently think about urban architectural surfaces. B. Hotel living walls are designed to help mitigate the bee Colony Collapse Disorder (CCD) and help grow and accommodate life locally for mason bees. CCD is one of the most important recent concerns associated with food supply in relationship to growing cities worldwide. According to the Agriculture and Consumer Protection Department of the Food and Agriculture Organization of the United Nations, the estimate value of the global crops that are pollinated was \$200 billion in 2005.

B. Hotel living walls are designed to precisely accommodate bee habitat strategically located throughout the city maximizing habitat proximity and the ecological urban matrix as a whole.

**Living Gills** - a hybrid modular system that uses sound, sculpture, light, plants, and network to create meaningful connections and beautiful spaces in the urban environment. Living Gills modular pocket system is inspired by mushroom gills with organic patterns of appearance, yet simultaneously modular qualities.

These modules harness the ever-growing influence of technology. They record information, such as temperature, air quality, noise pollution, and other site factors. This information can be retrieved on a smart phone and compared with other modules throughout the city. Living Gills modular pocket systems are designed to promote education and awareness of environmental qualities, to influence improvements to our built environment, to encourage curiosity, and to inform the general public about the importance of nature in cities.

**Wabi Sabi** walls - a hybrid green wall with built-in air purification made from organic concrete is inspired by the principles of the Japanese philosophy; Wabi Sabi. Breathing Walls provide urban living systems benefits through ecological patterns of concrete membranes or skins celebrating change over time. Breathing Walls are constructed using a combination of traditional Portland concrete, air purifying porous concrete, and biological concrete. The three materials are stacked horizontally like veneer. Each type of concrete has its own properties that contribute to the overall performance. Together they require little maintenance, are cost effective, and induce unique patterns of growth and erosion.

Function, aesthetics, and time effectively collaborate to encourage the re-imagination of urban concrete surfaces to become new hybrid green infrastructure landscapes.

## HISTORY AND THEORY



# Elisaeus von Seutter's "Ivy Cottage": A Southern Victorian Garden in Photographs

**Michael W. Seymour** Mississippi State University

**Peter Summerlin** Mississippi State University

German immigrant Elisaeus von Seutter was one of the earlier photographers in Jackson, Mississippi and also an avid gardener. Von Seutter came to the United States in 1848 but didn't move to Jackson until after his property and business in Raymond were mostly destroyed as a result of the Civil War. In the decades that followed, von Seutter built a jewelry and photography business and a home for his family, which they called "The Ivy Cottage." This Victorian-style cottage and its streetside garden were the subject of many of the von Seutters' photographs. These compelling garden photos show a lush, dynamic landscape that received considerable care, thought and attention and featured an extensive plant collection, fountains and even a lotus pond. The quality and quantity of these photographs provides the rare opportunity to explore in detail the design and evolution of a postbellum Southern garden. Due largely to limited documentation, vernacular gardens of this period have received minimal scholarly attention.

The examination of "The Ivy Cottage" followed a methodology that the authors devised for analysis of historic landscape photographs (the subject of a prior presentation). The process requires initial exploration of the contextual information necessary to understand the subject matter of the images. The reviewer then identifies the location of the image on historic maps in order to understand the surrounding physical context. Finally, the photograph is annotated to identify each visible object and an overall written analysis is completed. This thorough process is intended to assist the reviewer in arriving at informed conclusions and a clearer understanding of the limitations of the photo collection.

This presentation will compare and contrast the information gleaned from the photographs with what is currently known about Southern landscape history of the period. The "Ivy Cottage" garden will be compared to the written recommendations and proposed landscape plans of such authors as Frank J. Scott, Jacob Weidenmann and Samuel Parsons. Although the von Seutters' garden was only one of many in Jackson at the time, it does provide an indication of some of the ways that Southern gardeners of the time might have adopted, adapted or ignored various trends of the day. But more importantly, the von Seutter photographs provide us with the chance to glimpse, however briefly, one family's well-loved landscape and to reflect upon the importance and fleetingness of our own home landscapes.

# Places of Intellectual Property

**Richard L Hindle** University of California Berkeley  
[rlhindle@berkeley.edu](mailto:rlhindle@berkeley.edu)

This presentation explores the history of site-specificity in patent documents, and the role of intellectual property in the design of complex environmental systems. Early patents for site specific works provide a rich history of environmental "design thinking" across a range of scales, from proposals of discreet buildings and landscapes to the redesign of regional scale hydrologic systems. The patent archive provides a rich dossier of innovations that, when coupled to specific locations, reveals a historiography of technology and environment relevant to landscape architecture. Links between patent innovations and known geographical locations dates back more than 225 years to the Patent Act of 1790, with evocative images and textual descriptions of places and natural systems. The presentation will begin with a short discussion of patents and site specificity, and then explore a series of patents that include, in image or textual descriptions, specific places hybridized with specific technologies. Primary sources for this research include environmental design patents from 1790-2015, historical court documents, models from the American Philosophical Society Archives, and new visualizations created by the author. The role of patents as design proposals for site-specific works will also be explored.

A representational anomaly exists among the more than 9 million U.S. patents granted since the ratification of the U.S. Constitution, in which intellectual property and 'place' converge into an evocative and confounding hybrid at the interstices of technology and environment. Although land patents have a long history in the surveying and transfer of government territories, the land patent itself was purely a legal mechanism for platting and documenting land ownership, and was not associated with any intellectual property or technological innovation. In this presentation I explore the interstices of 'intellectual property' (i.e. patents) and 'real property' (i.e. improved lands) as examples of how ideas and innovation changed places and the broader landscape. Known geographical places are rarely represented in patent text and image for good reason. The specificity of place precludes the widest interpretation of patent claims, and is therefore omitted from legalese that aims to protect the broadest interpretation of intellectual property. Also, any direct correlation between the configuration and functioning of a novel invention and specific location, landscape, or environmental condition does not always exist – obviously. The schism between patent innovation and specific geographies is, however, not absolute. Inclusion of known spaces, places, and landscapes, within patent text and image charts a complex transect through a terrain vague of environmental innovation, and reveals a uniquely American geography.

# An Infrastructure of Innovation: levees, patents, and the Department of Interior 1849-1925

**Richard Hindle** University of California Berkeley

[rhindle@berkeley.edu](mailto:rhindle@berkeley.edu)

This presentation explores advances in levee design and in the late 19th and early 20th century, and the legal, cultural, and technical ‘infrastructure’ that supported innovation in large-scale landscape ‘infrastructural’ systems during the period from 1849-1925 when the United States Patent and Trademark Office (USPTO) operated within the Department Of Interior. An important objective of this research is to highlight historical precedent for design innovation in regional landscape systems and mechanisms for the diffusion and adoption of new technology. This subject is made timely by Landscape Architectures renewed role in the design of complex environmental and technological systems, such as those required to respond to sea level rise, drought, and increased flood frequency. Primary sources include early patents for levee design, expert testimony to congress, promotional materials boosting regional infrastructure, policies that consolidated federal engineering projects, and the relationship of these factors to the extant levee systems of the San Joaquin and Mississippi river deltas. Special attention will also be given to unrealized levee designs and their potential impact on the American Landscape.

The history of levees in the United States is well documented, yet the technical aspects of levee design and construction were by no means a foregone conclusion in the early decades of the 20th century. The search for reliable flood control methods and levee-building systems catalyzed innovations in design and patent submission. The iterative process of innovation is clearly chronicled in the U.S. patent archive, providing a rich history of invention, as well as a natural precedent for the diffusion of levee technology. Individual inventors of the era posited levee designs with the USPTO in an attempt to provide technological solutions to flooding and river control while disclosing and describing their inventions through established legal mechanisms. This increase in levee patents coincides with a period of unparalleled growth in national infrastructure, and with the USPTO operating under the auspices of the Department Of Interior, which was founded to manage domestic and land related issues. Patents from the era chronicle a flurry of innovation in landscape infrastructure, providing insights into early bioengineering techniques, hydrologic design, and the mechanization of American landscapes, in addition to levee infrastructure. Although the methods for this presentation are primarily historiographical, a subtext to this presentation is the potential for new landscape technologies and innovative processes to transcend scales and impact ecological and regional systems. Importantly, innovation in levee systems may provide important precedent for contemporary Landscape Architecture operating in an new era of expanding professional scope and increased environmental threats from sea level rise and climate change.



# Roberto Burle Marx in Brasília: The Ministries and the Military Dictatorship

**Catherine Seavitt Nordenson** City College of New York

[cseavitt@seavitt.com](mailto:cseavitt@seavitt.com)

In 1970, Robert Burle Marx designed a 30-acre triangular formal garden, the Praça dos Cristais, adjacent to Oscar Niemeyer's 1968 Ministry of Defense complex in Brasília, Brazil. Burle Marx also designed unexecuted gardens for the plaza of the Ministry headquarters and the generals' residential quarters. William Howard Adams featured the Praça dos Cristais in his 1991 Museum of Modern Art exhibition on the work of Burle Marx, but notes its isolation and neglect in the accompanying catalogue. Reinaugurated in 2009 after almost two years of restoration, the plaza was landmarked by the Federal District government in 2011. The garden highlights native species of the *cerrado*, Brazil's tropical savannah ecoregion, as well as symbolically referencing the mineral wealth of the state of Goiás through the placement of large crystalline blocks of concrete within its central water gardens. The plaza's geometric pavement patterns, executed in the traditional *pedra portuguesa* technique using black, white, and red stones, evoke the late hardscape projects of Burle Marx such as the 1969-1971 Avenida Atlântica promenade in Copacabana, Rio de Janeiro.

However, the Praça dos Cristais also evokes two rarely discussed moments in the oeuvre of Burle Marx: his exclusion from the initial planning and execution of the new capital city of Brasília under President Juscelino Kubitschek, 1956-1960, and his later consular affiliation with Brazil's military dictatorship after the coup d'état of 1964. An earlier dispute between Kubitschek and Burle Marx regarding payment for his design services for the gardens of the Pampulha complex of the early 1940s, commissioned by Kubitschek while governor of Minas Gerais, led to a deep rift between the two men. Burle Marx's later projects in Brasília, all executed after Kubitschek's presidency, include the gardens of three of government ministries: the Ministry of Foreign Affairs, the Ministry of Justice, and the Ministry of Defense. All were completed while Burle Marx served as an advisor to the military regime as a member of the *Conselho Federal de Cultura*, the Federal Council of Culture, from 1966-1973. Appointed by President Humberto de Alencar Castello Branco, Burle Marx leveraged this powerful political platform as cultural advisor to argue for the conservation and protection of the natural and cultural landscapes of Brazil during a period of rapid development. And, unlike Niemeyer's departure into self-exile in Paris during this same period, this ethically troubling relationship with the regime appears to have gained Burle Marx several significant commissions for Brasília.

# Too Big to Fail: Mathematical Modeling and The Blue Dunes ReBuild by Design Proposal

**Kathleen John-Alder** Rutgers University

[kjohnalder@gmail.com](mailto:kjohnalder@gmail.com)

The mathematical modeling of complex systems using non-linear differential equations is routinely used for diverse purposes, including predicting the likely behavior of blood flow, nerve formation, the stock market, a dripping faucet, wind and water turbulence, and storm surge. But this type of applied science, as illustrated in the work of Edward Lorenz in the early 1960s, raises nagging questions. How accurately can we model the world's complexity and predict its future? Can we, in turn, apply these predictions to mitigate risk, increase safety, and improve health and welfare, and then guarantee these benefits long into the future? Should we, in other words, allow our fate to be decided by inherently uncertain mathematical equations that require empirical testing and can only be validated in hindsight? These questions are at the heart of an audacious proposal for a string of barrier islands stretching from central New Jersey to the eastern tip of Long Island presented by West 8 and WXY Blue Dunes in their submission for the ReBuild by Design Competition.

This presentation examines the role of mathematical modeling in landscape architecture using the Blue Dunes ReBuild by Design proposal as a case study. Of particular interest are team discussions regarding the scale and intent of the project, and the close correlation of this discussion to personal judgments regarding the effectiveness of mathematical modeling. The physical geologists Orrin Pilkey and his protégée Rob Young, both modeling skeptics, occupied one end of the spectrum and argued for cautious, anti-interventionist ecological restoration and planned abandonment. The landscape architect, Adriaan Gueze, in contrast, fully embraced the conceptual power of mathematical modeling and used it to daringly justify the alteration of a large swath of coastal topography. WXY Architects, the lead firm and coordinator of the team, had to mediate this difference. The task would ultimately prove to be impossible.

In order to understand the team's internal debate regarding mathematical modeling, this presentation first illustrates the impact of personal experience and cultural backgrounds upon the stances taken by the individuals involved. It then illustrates how these differences not only promoted opposing visions of the coastal landscape and its development and protection; they also led to the transplantation of a design solution developed for the Netherlands to the eastern shore of the United States. Key texts, illustrations, and project reports are referenced to situate this presentation within a larger historical context.

# BUILT WORKS AS MANIFESTATIONS OF DESIGN PHILOSOPHY: THE JOHN A. SIBLEY HORTICULTURAL CENTER AND THE CECIL B. DAY BUTTERFLY CENTER AT CALLAWAY GARDENS

**Sarah Georgia Harrison** University of Georgia

This paper evaluates two design projects by Robert E. Marvin & Associates as demonstrations of his design philosophy. The John A. Sibley Horticultural Center (1986) and the Cecil B. Day Butterfly Center (1990) at Callaway Gardens in Pine Mountain, Georgia were both designed with Marvin as the leader of the project team. Individually and collectively they are representative of his mature design philosophy.

Robert Marvin (1920-2001) was a prominent landscape architect in the southeast, who practiced from the small town of Walterboro within the Lowcountry of South Carolina. Over a career that spanned five and a half decades, he received numerous recognitions and awards for his accomplishments, culminating in the 2001 ASLA Medal Award, the profession's highest distinction. His design philosophy centered on the creation of harmony between man and nature, incorporating inside/outside relationships in his regionally sensitive approach to Modernism. Attention to the comfort of the user and creating human-scaled spaces were other key components. His work also exemplified an alignment with the environmental movement, manifested by an emphasis on a concept's appropriateness to the site and energy conservation. His design process, coined "indigenous planning," included careful consideration of the "dreams of the client, the need of the times, the technology of the day," and the specific site conditions.

These two selected projects provided the opportunity for Marvin to express some of his core values in design such as heightening the experience of nature by elevating awareness of plant and animal species; providing a sequence of movement through indoor and outdoor spaces of the conservatories; articulating the scale of the experience by alternating contraction and expansion of space and by a controlled descent through changing habitat. Energy conservation applications, such as the use of passive solar energy, will also be discussed.

This study is part of continuing research about the legacy of Robert Marvin in landscape architectural history. By focusing on individual built works, this study will illustrate by example the design concepts and philosophy of Mr. Marvin. Research methods included interviews with former associates, family members and peers; observation of project site conditions; and research of design documents, office files, published secondary sources and unpublished personal notes obtained from archives at the University of South Carolina's Carolinian Library.

# Mosaic Modernity: the Public Park in 20<sup>th</sup> Century China

**Mary Padua** Clemson University  
[mcpadua@clemson.edu](mailto:mcpadua@clemson.edu)

Scholarly work that examines the design history of the public park over the course of China's 20<sup>th</sup> century has yet to be written. This paper represents preliminary research that offers revelations on the development of this universal urban and landscape architecture prototype within the context of navigating the multi-dimensional and fragmented terrain of China's 20<sup>th</sup> century modernity. It posits the nexus between the 20<sup>th</sup> century development of designed landscapes in China's urban public realm, the notion of modernity and China's nation-building (modernization) efforts. This paper is essentially a qualitative research project in theory-building, history and *design inquiry* and partially speculative. It is 'located' within an intellectual, critical and interpretative approach employed by Meyer (1991), Treib (1993, 2011), Hayden (1995), Jackson (1994), Jencks (2012) and others. The physical form of design is emphasized but interprets it in wider historical, social, cultural, economic and political contexts (Hayden 1995). In navigating China's modern 20<sup>th</sup> century, I build a discursive narrative around four critical, discrete and sometimes overlapping strands of transformation referred to as "moments of modernity" that reveals a mosaic cultural phenomenon. I deem the evolution of the public park in China's 20<sup>th</sup> century as representative of "mosaic modernity". It represents processes of modernization, derived out of China's 20<sup>th</sup> century revolutionary praxis and the interplay of shifting socio-political strife, foreign influence, cultural identity and nationalism or nation-building. This paper is revelatory and presents the four sometimes overlapping "mosaic" periods of China's 20<sup>th</sup> century modernity: 1) colonial (1840's to late 1930's); 2) Republican (1912-49); Maoist (1949-1976); and 4) post-Mao or hybrid modernity (Padua 2006). It concludes with a discussion of ongoing and future research and speculates on the role and meaning of the public park for 21<sup>st</sup> century China, particularly with central government's policy for ongoing urbanization and expectations for an additional 400 cities by 2020 (Liauw 2008). As the first historical documentation and critical analysis of the public park in modern China, this work is preliminary, yet breaks new ground. It initiates a bridge between the literature in China and the West and sets the foundation for future research. It contributes to closing the gap in the literature on 20<sup>th</sup> century modernity, landscape architecture and urbanism in China.

# Before Brasilia: Niemeyer, Kubitschek and the creation of the Pampulha Cultural Complex

**Clark Taylor** UCLA

Brasília, founded as the new national capital in 1960, is an icon of Brazil's hope for a progressive and modern future. Brasília and the city's designers have been the subjects of a rich historical, geographical and architectural literature. However, less is known about a similar project, smaller in scope and scale, carried out 20 years earlier outside the city of Belo Horizonte, Brazil by two of the key creators of the national capital: the then Mayor of Belo Horizonte, Juscelino Kubitschek (who would go on to be President of Brazil); and a young, not-yet-famous architect, Oscar Niemeyer. This project, the Pampulha Cultural Complex - a leisure and entertainment zone in the city of Belo Horizonte, Brazil - was politically developed by Kubitschek and the buildings and site were designed by Niemeyer. This paper traces the development of Brazilian Free-Form Modernism (especially its impact on the landscape) beginning in Pampulha and the eventually culminating in the creation of Brasília. The connections between the two projects are analyzed and the resulting insights into the legacy of urban design in Brazil are discussed. Special attention devoted to the case of Belo Horizonte - now Brazil's third largest city. Laid out as a new provincial capital and "planned-city" in the state of Minas Gerais in 1893, the original city planners of Belo Horizonte were devotees of the City Beautiful and Beaux-Arts movements in urban design. The Pampulha site stands in contrast to the original city plan and its creation not only illuminates the histories of two of the key actors in the creation of Brasília, it also demonstrates the evolution of the Brazilian urban vision since the republic was established in 1889. The ways in which the Pampulha project sought to overthrow traditional notions of urban space and place, embrace the ideals of a democratic, globalized society and address dramatic and entrenched economic inequality are examined through archival and historiographical research. After outlining a brief introduction to the city and the Pampulha site, the paper then examines the specific ways the design of Pampulha is a reaction to and rebellion against *some* existing urban forms, social practices and political maneuverings while at the same time is an extension and even acceptance of others. The tensions between local and national scales, public and private space, as well composition and object in the landscape are explored in the specific context Pampulha and Belo Horizonte.

# Roads, Rivers and Resources: Mapping Rome's Building Materials Landscape.

**Joseph Ragsdale** Cal Poly San Luis Obispo

[jragdsdal@calpoly.edu](mailto:jragdsdal@calpoly.edu)

Not far outside the protective walls of ancient Rome lay the source landscapes for the building materials used throughout the ages in the construction of the Eternal City. Those materials include volcanic and sedimentary stones, clay and Pozzolana, also known as pozzolanic ash – a key ingredient in Roman Concrete (Ashby, 1902, Blake, 1947, Rowland, 1999). While much is known and written about Rome's urban design, architecture, monuments, art and gardens, only compartmentalized research exists for the landscapes, communities and infrastructure that supported, and continues to support, development in the city. Recent research has examined the geologic and volcanic origins of Rome (De Rita, 2000, Jackson et al, 2005/06); translations of historic texts and ongoing research has examined the building materials and construction technologies used within the city (Rowland, 1999, Taylor, 2003); and isolated research has documented individual quarry and community sites around Rome (Farr, 2014, Quilici, 1974). This study examines and maps the landscapes, communities, quarries and infrastructure for the primary building materials used in Rome from the fourth century BC to modern times. The study focuses on the primary or structural building elements for buildings, walls, temples, piazzas and streets while excluding materials imported for veneers, individual features or art works.

Using compartmentalized resources (an extensive literature review, historic and contemporary maps, satellite photos, GIS data and field verification), a timeline and series of maps compile and document the building materials landscape of Rome. The timeline references key built elements and the evolution of material source landscapes. A series of maps and diagrams highlight the source sites, transportation infrastructure, and associated communities in relationship to geological, topographical and ecological features. The outcomes portray a complex and evolving landscape in support of the construction of Rome. Key findings include the identification of ephemeral vs. lasting material source landscapes, the relationship of communities and transportation networks to source landscapes and the small radius in distance from the city center from which most building materials originated. The results add to the body of research on Rome's construction and building materials history while looking at the role of the landscape in the development of the city and the impact this development had (and continues to have) on the landscape. The landscapes surrounding Rome have supplied building materials to the city and beyond for over 25 centuries. Revealing these landscapes can serve as a key precedent when looking at modern sustainable development in the areas of the origin of materials, transportation infrastructure, and reuse of productive sites.

# "Records of a Dream": Agricultural Infrastructure and the Gardens of Middleton Place

**Roxi Thoren** University of Oregon

Using archival records and map regressions, this essay tells for the first time the story of an extraordinary Colonial landscape and reveals the agricultural technology that made it possible. It reveals the relationship between the agricultural landscape and formal gardens, identifies gaps in its historiography, and proposes a new understanding of the plantation and gardens.

Middleton Place is often called the oldest extant designed gardens in America. The family seat of the Middleton family's rice enterprise for over a century, the 7,000-acre plantation outside of Charleston, South Carolina is renowned for its formal gardens, which centered on the house and used perspectival views to extend into the landscape along an axis down the Ashley River and through alleés carved into the surrounding forests.

Despite its significance, Middleton Place has never been studied as an integrated garden and agricultural landscape. Garden histories of the plantation discuss the extraordinary terraces stepping down to the river, and the Le Notre-inspired gardens that use a nearly-mile-long bend of the Ashley as a water axis at the scale of Vaux le Vicomte. The gardens, destroyed by war, earthquake, and neglect, have been misinterpreted based on their partial reconstruction in the twentieth-century, and have never been analyzed or critiqued as embedded within an agricultural landscape.

The infrastructure of rice production is essential to understanding the gardens. Formally, the two landscapes contrast each other, the dendritic rice fields providing a ground for the abstract geometry of the gardens. Theoretically, the landscape of rice production mediated between the first nature of swamps and the third nature of the gardens. And technically and socially, the fields support the gardens; the baroque terraces were constructed using the technology of reservoir and dyke construction, while reflecting pools used the trunk and dam system of the tidal rice irrigation.

The plantation provides a revealing reminder of the difficulty in studying historic landscapes, especially in regions devastated by war or natural disaster. The house and gardens were damaged in both the Revolutionary and Civil Wars, but it was a devastating earthquake in 1886 that erased most of the physical history of the larger designed and cultivated landscape and obscured the garden design well into the twentieth century. Based on archival evidence, this paper proposes a new formal reading of the garden, proposing that large pools and extensive terraces were destroyed in the earthquake.

# Joe Deal's photography of the American West and the notion of objectivity.

**Anne C Godfrey** University of Oregon

Is objectivity possible in the photographic representation of landscapes? Is it necessary? Joe Deal's (1947-2010) photographs of western suburbs, cities and vast man altered landscapes have the appearance of objectivity. They are black and white, low contrast photographs taken from a point of view distant from the subject, as if looking from afar in order to examine the scene. Deal himself, as a participant in the paradigm shifting *New Topographics: Photographs of a Man-altered Landscape* show at the George Eastman House in Rochester, New York (1975) made statements in regards to an even handed objective method. "In making these photographs I attempted to make a series of images in which one image is equal in weight or appearance to another"(Deal 1974).

Using Deal as the case study, this work explores the idea and meaning of objectivity in photographs of landscapes. Is the notion of objectivity helpful to how we study landscapes today? How has the very idea of objectivity changed? Deal is a significant figure because he created a new visual paradigm for the photographic representation of landscapes of the American West.

Is objectivity possible, necessary, impossible, or something in between? The author lays out the ideas behind Deal's photographs through examining Deal's primary writing about his major bodies of work. This work is presented in five significant books, starting with the *New Topographics* (1975) and ending with *West and West* (2009). This examination compares Deal's own words to the cultural and philosophical context of the 1960's and 1970's through to 2009. Deal's ideas shift over time, as do cultural values about objectivity, and the relative importance of the idea of objectivity. The author will compare Deal's changing ideas with the usefulness, application and dismissal of the idea of objectivity in relationship to landscape thinking in the late 20th and early 21st century.

The author realizes the definition of objectivity is difficult so defines objectivity through the lens of the time period of Deal's major work (1970-2010). The idea of "scientific method" dominates the definition of objectivity especially as it is applied to McHarg's *Design with Nature* (1969). Objective ways of measuring humans' impact on ecological systems becomes common practice in the 1960's and 1970's, supporting such popular work as Rachel Carson's *Silent Spring*. Deal's work, contextualized by these concerns, serves as a specific case through which to revisit the ideas and ideals associated with the concept of objective representation.



# Rohwer Reconstructed: Interpreting Place through Experience

**Kimball Erdman** University of Arkansas  
[kerdman@uark.edu](mailto:kerdman@uark.edu)

In the incredibly short span of about four years, 1942 to 1946, some five hundred acres of the Mississippi River Delta in southeast Arkansas were transformed from a tree-covered swamp, to a barren military-style camp, and then to a resourceful community of more than 8,000 involuntary residents, before being wiped clean of almost all traces of this community and replaced with productive farmland. The former Rohwer Relocation Center, located near the small agricultural community of Rohwer, Arkansas, was one of ten World War II-era internment camps holding Japanese-Americans from Pacific Coast states between 1942 and 1945. Although few visible clues remain today, the landscape created by the War Relocation Authority and transformed by the internees once revealed cultural identity, challenged patriotism, and a determination to make a home in extremely difficult circumstances. In 1961 an article in a regional paper recalled that “Rohwer in its heyday looked like a cross between a concentration camp and a museum garden; seldom has so much to gratify the senses been created out of so little” (A Federal Charge. *Pine Bluff Commercial*, 1961, October 17, p. 4).

*Rohwer Reconstructed: Interpreting Place through Experience* is both the title of this paper and of an ongoing, multidisciplinary project made possible by the Japanese American Confinements Sites grant program. The main goal of the grant project is to tell the story of this ephemeral landscape and the people who created it, helping ensure their legacy preserved for future generations. Two primary objectives of the project team are to 1) enhance the experience and understanding of the physical site through a virtual reconstruction of a typical residential block, and 2) improve access to documents and material objects related to Rohwer that are currently scattered among numerous Arkansas institutions. Half of this paper describes the evolving character of the ephemeral internment camp landscape explores the history and physical conditions that shaped the gardens created by Rohwer internees. The second half of the paper delves into the challenges of documenting and interpreting a landscape with extremely limited physical evidence but substantial historic documentation (albeit fragmented and incomplete) and details the solutions utilized by the project team.

# Cultural Landscapes and The National Map: Examining the U.S. Geological Survey's Shifting Priorities in the Digital Age

**Elisabeth Orr** West Virginia University

The history of the U.S. Geological Survey (USGS) is well documented. USGS is responsible for mapping our nation's physical and cultural features, and published the well-known 1:24,000-scale U.S. topographic map series completed in 1992 (updated through 2006). In 2009, the USGS abandoned paper maps and began offering maps derived solely from Geographic Information Systems (GIS) data and made available online. Today, the USGS's National Geospatial Program provides comparable – but not equivalent – data digitally through *The National Map* (TNM), which it describes as “a set of basic geospatial information provided as a variety of products and services” (USGS 2011).

Landscape architects have long relied on USGS maps for landscape information. In addition to including elevation data and contour lines, the printed maps showed, and named, natural and manmade features including cultural buildings and landscapes such as churches, cemeteries, and parks.

Many landscape architects are not aware that in October 2014, the Geographic Names Information System (GNIS), under the purview of USGS, announced the suspension of “maintenance of some administrative features (i.e. cultural or manmade)” in TNM (GNIS 2015). Though they plan to maintain the “administrative names” of eleven “structure features” in TNM on a periodic basis, only one is a *landscape* feature: cemeteries. The GNIS will no longer maintain landscape features such as parks, dams, mines, bridges and many others.

It should be noted that the historic USGS maps (completed in 1992) are available online using web viewers and in GIS accessible formats. However, the complexity of the USGS organizational structure (and web presence) makes finding historical and cultural data challenging. This project argues that the new GNIS policy reduces important cultural features in TNM therefore creating a significant loss of data relevant to landscape architects and allied professionals.

Using ArcMap software to create a custom geographic information system (GIS), this project collates and analyzes cemetery locations in Preston County, West Virginia – both those that are historically included on USGS topo maps and those that are not – as a case study. Here, many cemeteries are technically independent of, but located adjacent to, churches. The GNIS/USGS often categorized these cemeteries in the “churches” feature class, which will not be included in TNM going forward, thereby eliminating them from current and future versions of TNM.

This project reveals issues relevant to studying cultural landscapes throughout the country given GNIS/USGS data maintenance changes.

# The Beginning of Landscape Architecture in Oklahoma

**Bo Zhang** Oklahoma State University

**Cheryl Milhalko** Oklahoma State University

A history of the beginning of landscape architecture in the state of Oklahoma does not exist and is fundamental to the examination of national and regional trends in landscape architecture as a societal phenomenon, a professional practice, and an academic program. This study investigating the inception of landscape architecture in Oklahoma and will reveal and contemplate the origins, public identity, limitations, and constraints of the profession and practice.

Scholarship has revealed the origin of landscape architecture in America with lessons drawn from New England, Mid-Atlantic, and the Midwest regions under the context of industrialization, urban development, and park system planning. To understand the identity of Oklahoma associated with landscape architecture, the history of landscape architecture in the state of Oklahoma will be explored. When Olmsted and Vaux adopted 'landscape architect' as a professional title in 1863, the Cowskin Prairie Council sought to establish an alliance between the Cherokee and the Confederacy to strengthen the political situation of the Cherokee Nation in the Oklahoma territory of unassigned land. Twenty six years later in 1889, the first land rush into the unassigned lands of Oklahoma took place and another eighteen years passed before Oklahoma was admitted to the Union as a state.

A triangular framework of society, practice, and education is proposed to balance the needs of each group with the other two, and also relatively to regulate them. Two inductive methods will be employed to gather research data. First, curriculum, syllabi, course documents, and student projects archived at Oklahoma State University and the University of Oklahoma will be gathered and analyzed in order to identify issues surrounding the inception of the programs, and the state of professional practice at that time.

Second, in-depth interviews will be completed with six ASLA state chapter ex-leaders, three professors retired from Oklahoma State University, two from the University of Oklahoma, and five state garden club leaders. The 60 - 90 minute interview will be videotaped and archived. The interview data will be categorized into the triangle framework and compared with archive data.

# Temple Garden at Naumkeag: A Chinese Inspired Garden in the U.S.

**Bo Zhang** Oklahoma State University

For Naumkeag, its rich Chinese characters have long been overshadowed by the famous Blue Steps, an iconic example of modernity. This situation is excusable but simultaneously unfortunate. Among private gardens in the early 20th century US that were inspired by Chinese elements, the author discovers that Naumkeag stands out among its peers, for multiple reasons. First, the Temple Garden at Naumkeag is the first Chinese garden designed by the hands of an American professional landscape architect. Both the owner of the garden, Mabel Choate, and its designer, Fletcher Steele, had traveled to China, while the latter having written about China (1946, 1964). Second, the Temple Garden, for the first time, presented an authentically composed Chinese courtyard, a spatial feature never appeared in a previous case. Third, the rich Chinese details in the garden indicated a thorough understanding of Chinese gardening, which far exceeded its forerunners.

In this study, two theoretic dimensions of authenticity and creativity are employed to understand Naumkeag's success as a Chinese inspired garden. The research questions include, which design principles, strategies, and techniques from China were understood, utilized, and compromised, and which are invented? How did Steele and Choate reach a consensus for an ideal environment by absorbing some Chinese features while deliberately transforming others, and why? How did the designed space accommodate the placement of Chinese artifacts? How were the design details, such as a temple, a latticework wall (yingbi), a trench system, piled stones, and a moon gate, implemented by local labors under the landscape architect's supervision, using a combination of exported and local construction and plant materials? Lastly, how did recent renovation reflect the authenticity and creativity of the original design?

This study is a part of an extensive research project "Chinese Influences on the Designed landscapes in U.S., 1860-1930", which was given a research grant by Chiang Ching-Kwo Foundation. Two products were presented at two previous CELA conferences. With the grant, the authors have conducted field studies on the site at Stockbridge, MA, visited several depositories, such as the Archives and Research Center of the Trustees of Reservations in Sharon, MA, and interviewed restoration experts and local historians.

# Revealing integrated industrial narratives through digital reconstruction of a historic cultural landscape

**Peter Butler** West Virginia University

[pebutler@mail.wvu.edu](mailto:pebutler@mail.wvu.edu)

**Charles Yuill** West Virginia University

[cyuill@mail.wvu.edu](mailto:cyuill@mail.wvu.edu)

At the center of the dramatic landscape change characterizing the Anthropocene (J. Zalasiewicz, M. Williams, W. Steffen, & P. Crutzen, 2010) is the cultural landscape of Gary, WV. The United States Coke and Coal Company (USCCC) conceived of the development of metallurgic coal mining in Gary, accompanied by coke production facilities and associated ‘exceptional’ (Sone, 1991) company towns within the region in the early 20th century to feed steel manufacturing in Pittsburgh, PA, Columbus, OH and other rust belt centers. Today, mountain-top removal (MTR) mining practices have disturbed the landscape at an alarming rate. The purpose of this study is to quantify landscape change in discreet areas in order to better understand the impacts of MTR and the choreographed disinvestment and erasure of the communities by US Steel Corporation.

Reconstructing and modeling the local topography, infrastructure, buildings and structures of the area through the digitizing of historical (topographic and underground mining) maps (1906-1928) allows researchers to compare historic pre-MTR conditions to contemporary circumstances. The use of aerial and static LiDAR (Light Detection and Ranging) instruments in documenting current conditions provides three-dimensional digital models that are integrated with digitized historic models revealing and quantifying change (Opitz, 2012). Findings deepen our understanding of the Anthropocene at a scale not previously measured within the region in bringing the volumes and movements of materials (Hooke, 1999) and populations to light. Visualizations of change will function as interpretive devices allowing for immersive virtual experiences that communicate a significant chapter of the history of the industrialization of the Appalachian Region and its connection to broader economic, social, and environmental trends.

# What's Happening Then: Living Museums and Living Landscape

**Justin Scherma Parscher** The Ohio State University

Living museums – open-air sites populated by actors, reconstructed buildings, and recreational activities – have traditionally been denigrated in design discourse as theme parks in respectable drag. Such institutions have been influentially viewed by commentators from Huxtable to Sorkin through a Baudrillardian lens: pure simulacra, selling normative and sanitized fantasies of history. Over the past few decades, as living museums have attempted to honor their stated commitment to accuracy by incorporating more complicated and unpleasant themes – slavery, oppression, inequality – they have been forced to reckon with the limits of their model. Separate tours of Colonial Williamsburg, led by black and white interpreters, directly contradict each other on racially-charged issues; Native American interpreters at Plimoth Plantation speak frankly to the brutality that followed the time depicted in the nearby village of settlers. As such workers problematize reconstructed landscapes from forests to gardens to urban fragments, they use what Kenneth Burke called a rhetoric of identification, soliciting the visitor to understand the surrounding environment through an empathetic new perspective. Is a tobacco field, for instance, a technical demonstration, or a scene of slave labor? In such moments, instead of sealing off conflict or dissent, the immersiveness of living museums makes the visitor reckon between the competing claims of persuasive actors.

The ongoing shift in how living museums negotiate leisure and history has direct implications for how meaning and memory may be approached in landscape design. As landscape designers increasingly look to create through indeterminate systems, they may similarly look to create sites that optimize a dynamic process of human performance and reception. The logic of how these spaces are laid out and maintained may be approached through what Ian Bogost, in his work on games, has called procedural rhetoric: a system of programmed events and frameworks that in prompting and rewarding certain behaviors models ways of understanding the world. Through site strategies that accommodate multiple readings and enable active re-making from interpreters and historians, designers may aid in rendering more inclusive and complex models of history. This paper uses three contemporary case studies in the interplay between landscape design and site interpreters - Plimoth Plantation, Colonial Williamsburg, and Greenfield Village – combining firsthand accounts of visitation with critical readings of primary sources (maps, brochures, advertisements) generated by these institutions. These experiences and texts are read through theoretical perspectives in rhetoric and discourse, in order to propose a new role for performance in landscape practice.

# *Wheatfield-A Confrontation*: The Work of Agnes Denes

**Kevin Benham** South Dakota State University  
[kevin.benham@sdsstate.edu](mailto:kevin.benham@sdsstate.edu)

This paper explores the work of conceptual and land artist Agnes Denes with particular emphasis on her seminal work *Wheatfield- A Confrontation*. The narrative situates the work of Denes in the larger canon of Land Art including Walter De Maria, Robert Smithson, Michael Heizer, and Nancy Holt, while recognizing that Dene's work transits a wide range of art genres from conceptual work, installation, writings, poetry, philosophy, drawing and digital representation. Although Denes is little known outside the art world, her body of work has recently gained greater attention, thanks in part to a Guggenheim Fellowship she received in 2015.

Her seminal work, *Wheatfield- A Confrontation*, was initially conceived in the latter part of the twentieth century and was first installed, in the early eighties, in Battery Park Landfill in downtown Manhattan. Since that first installation, the work has been installed repeatedly in other urban edges throughout the world, most recently in Milan, Italy.

This paper argues that Denes' work differentiates itself from other Land Art in some very important and innovative ways. First and foremost, the installation uses living material that is dependent on the geology, hydrology, biota and climatological conditions inherent on the given site. As a result, the soil conditions, existing pollutants, weather, and other factors affect the growth of the wheat in its various incarnations and the resulting harvest. While other land artists use organic material or plants in their works, Denes' work is imbued with special significance by the act of preparing soil, sowing seed, and harvesting the crop.

Additionally, the artist purposefully contextualized the work, not in a desolate and pristine environment, but rather at the rural/urban edge. The deployment of the work at the urban edge is a strategic decision that allows Denes to mine the political, geographic, and cultural history inherent on the site. This confrontation between these two spheres provides a conceptually rich piece that is amplified by the temporal quality of the work.

As landscape architecture makes a pendulum swing towards Landscape Urbanism, Denes' work situates itself at the Urban | Rural edge and reminds us that landscape is neither rural nor urban, but rather a continuum that is based on context.

# Engineered Flow: A Sociotechnical Analysis of Austin's Waller Creek Transformation

**Jason Sowell** The University of Texas at Austin

The construction of the Waller Creek flood diversion tunnel in downtown Austin, Texas transformed an urban waterway into an engineered system. In addition to flood control, the tunnel's completion initiated a redevelopment proposal that is expected to reclaim twenty-eight acres previously located in the one hundred year flood plain, catalyze the design of a new chain of parks, and enhance the creek's ecological health. Central to the plan's objectives is the integration of the hydrologic system with the park's proposed cultural programs and spatial experiences. At question, however, is the degree to which this interface requires a calibration among hydrologic processes, infrastructure, and social choices.

This paper draws upon a Science and Technology Studies (STS) framework to analyze the relationship between the existing tunnel's technical operation and the proposed park's programmatic development, formal organization, and material choices. As a relational framework, STS reveals the non-neutral connections between actors and technological choices as design processes unfold and built outcomes anneal. While early STS analysis focused on the evolution of discrete technologies, more recent scholarship has expanded to investigate human-managed environments as technological systems (Bijker 2012). This shift suggests the relevance of STS for assessing landscape's technical context, with the primary argument that STS provides a systematic method for understanding relationships between biophysical processes and technical choices.

The data to support this argument is derived from content analysis of pertinent literature, reports, media accounts, and informant interviews with project designers, leaders, and officials. The key contributions of this paper include: 1) a greater understanding of how the park's design process mediates the constraints imposed by the tunnel's engineering, economic considerations, and its location within a broader hydrologic system (Hommels 2005); 2) insight into the implications that arise when landscape is framed as a sociotechnical system; and 3) the relevance of STS thinking for contemporary landscape theory.



# The Lost Cause and Reunion in the Confederate Cemeteries of the North

**Ned Crankshaw** University of Kentucky

When nine African American members of a Charleston, South Carolina Bible study group were murdered in June 2015 by a white man who displayed the Confederate battle flag in online posts, a tide of political opposition quickly turned against the flag's display in public places. Discussion became more troublesome as it expanded to Confederate monuments and memorial landscapes. The coded language of Confederate memorials references ideas that seem universally appealing like honor, duty, and loyalty. Memorials are often alleged to simply mark events of the past, but they assert claims on history and represent intentions to mold the ideological future. They may be complicated, but Confederate monuments and the landscapes that contain them are not innocent.

Union states contain the remains of 26,000 Confederate prisoners of war who died in confinement and were buried in prison cemeteries between 1861 and 1865. The government of the United States neglected Confederate prisoners' cemeteries after the war, but in the 1890s, the Lost Cause movement began to appropriate them as repositories of Confederate symbolism. This was part of the broader southern campaign to reconcile defeat, to reassert southern partisanship, and to normalize Jim Crow's intensifying oppression of African Americans. The parallel reunion movement in the North valorized white southern honor, sidestepping the issue of slavery and abandoning racial justice as it sought regional reconciliation. The reunion sentiment inspired the formation of the United States Commission for Marking Graves of Confederate Dead in 1906, whose work resulted in the systematic placement of monuments to deceased Confederate prisoners interred in northern Federal cemeteries.

Confederate cemetery landscapes in the North exemplify the complexity of the larger set of Confederate memorials in the United States. They complicate and conflate death and ideology, honor and dishonor, racism and silence about racism, but never do they speak against racism. A very few show that the dead can be recognized with grace while declining comment or endorsement of the dead's cause.

The dilemmas of Confederate memorials in the United States will not be unpacked easily if by easily one means a quickly developed consensus, without requirement of nuance, which can be broadly applied without significant controversy. As the discussion about the enshrinement of racism in monuments and other memorials in the United States continues, we should debate Confederate memorials vigorously, understanding the stories of their production and recognizing that the patina of age does not release them from scrutiny.

# Coming to Terms with a Troubled Past: Charting the Spatial Legacies of Racial Segregation at a Land Grant University in South Carolina.

**Martin J. Holland** Clemson University

With national headlines gripped by the social unrest present within African American communities from Ferguson to Baltimore, a heated debate on how to confront and address the painful legacies of white supremacy within public sphere has emerged. It was only *after* the brutal murders of nine people at the Emanuel African Methodist Episcopal Church in Charleston, that the Confederate flag was finally removed from the South Carolina capitol grounds, although done under protest of a vocal minority stating that their own cultural heritage was under attack by the forces of political correctness. Public universities across the United States are grappling with a similar dilemma; how to reconcile the difficult pasts of key institutional figures while also trying to serve the larger, public, educational mission. For instance, The University of Texas at Austin recently removed a long controversial statue of Jefferson Davis, the President of the Confederacy, from public display citing that it was going to be cleaned, restored and relocated inside the University's Briscoe Center for American History. Many hope that the statue remains in storage indefinitely.

This presentation documents the efforts of students and faculty of the College of Art, Architecture and the Humanities to articulate the multiple, suppressed spatial and cultural histories that constitute Clemson University, a land grant, post-secondary educational institution located in the "upstate" area of South Carolina. The official history of Clemson contains scant information regarding the Native American communities that were forcibly displaced from the campus area by European settlers, or of the local African American communities that provided the vital labor for the daily operation and development of the University.

The purpose of the Clemson Historical Trail Tour is to provide a visitor not only with crucial historical information regarding the area, but to convey and augment that knowledge through bodily engagement with the relatively unmodified topography of the campus. As a result, a new understanding of place and the impact of the spatial legacies of segregation and forced labor can be experienced. As Dean MacCannell observes in *The Ethics of Sight-Seeing*, "There is only one place where painful memory is maintained, considered and preserved: in the minds and hearts and the expressions of visitors." Relying on student docents to host the walking tour, the journey provides an alternative form of knowledge to counter to the institution's preferred written narrative of social tolerance, peaceful integration and multicultural diversity.

# Eugenic Utopia: Health and Social Segregation in Garden City

**M. Elen Deming** University of Illinois at Urbana-Champaign  
[medeming@illinois.edu](mailto:medeming@illinois.edu)

In the long history of planned urban form influencing public health, one important chapter is the British utopian program called Garden City. Originally proposed in 1898 by Ebenezer Howard as a low-density socialist solution to the problem of depopulated rural districts and overpopulated Victorian slums, Garden City is now considered one of the main progenitors for a surge of Anglo-American new towns and suburbs after World War One. Contemporary with the founding of the Garden City movement at the turn of the twentieth century, enthusiasm for the science of eugenics (a theory of selective genetic improvement) was already widespread in Europe and the United States. Fear of “race degeneration,” especially in relation to class divisions (and not as “race” is understood today), was actively debated in England. From the turn of the twentieth century to the interwar years, many eugenicists embraced the idea of Garden City as a promised land of social and physical health.

In an effort to understand how eugenic values may have been encoded and/or structured in Garden City landscapes, this paper analyzes period discourse on garden type and design, family gardening activities, and social class, in several projects built before World War One. Sources include primary texts, propaganda, photographs, design drawings, reviews, and secondary studies drawn from the model industrial villages (Port Sunlight, Bournville, New Earswick), orthodox Garden City (Letchworth), and garden suburbs (Ealing, Hampstead Garden Suburb, Gidea Park). Period advocacy for Garden City suggests that social reformers valued gardens as a way to promote collective genetic health (measured by family size and children’s health), as much as personal health (measured by temperance and initiative). Gardening itself was thought to physically condition workers to become soldiers and, after returning from combat, loyal citizens living in improved worker housing were expected to regenerate and repopulate the British “race.” Further, Garden City responded to period political fears of worker uprisings and embrace of Bolshevism, because low-density urban housing ensure the separation of workers’ bodies in space.

Because eugenicist motives, even forgotten, have remained critically unexamined in the context of other historical factors governing 20<sup>th</sup>-century urban development, this paper concludes by raising new questions. Were the urban reformers behind Garden City eugenicists? What, if any, is the extant role of today’s ordinary single-family house and garden in eugenicist ambitions?

# The Landscape Painter's Park: The Forest at Fontainebleau

**Chip Sullivan** University of California, Berkeley

My presentation will discuss the critical role of the Fontainebleau forest in the development of landscape painting as a genre, emblematic of the creative subconscious of the Romantic era.

Symbolic of 19<sup>th</sup> century French national pride, a portion of the once royal forest was set aside in 1861 as a nature preserve. The forest, with its dramatic views, gigantic ancient oaks, and diverse ecosystems, was a popular destination for excursions by the growing bourgeoisie of Paris.

The forest at Fontainebleau also provided endless inspiration for painters of the Barbizon School, including Théodore Rousseau and Jean-François Millet. The vibrant artists' community at Barbizon emerged along the western edge of the forest, where extreme variations in topography and bizarre rock formations captivated and sparked the imaginations of the artists. Symbolically, the rational order of the town and the agricultural fields contrasted with the wild edge of the mysterious forest, fueling the Romantic imagination of the plein-air painters who resisted the neoclassical traditions asserted by the French Academy at the time and painted from direct observation of nature. By the 1860s, around a third of paintings exhibited at the Paris salons were landscapes.

At the urging of Rousseau and others, who were critical of the effects of unchecked tourism and industrialization on the forest at Fontainebleau, Napoleon III established a preserve to protect the forest so beloved by the painters. In this presentation I will touch upon the larger themes of landscape representation, with particular focus on the development of landscape painting as an accepted genre, and examine the relationship between the artistic community at Barbizon and the growth of environmental awareness.

*"For half a century, the forest of Fontainebleau had been the premier center for artistic experimentation--the crucible in which the modern landscape was forged." (Jones)*

# Weldon Gratton's Panoramic Overlook for Theodore Roosevelt National Park

**Matthew Kirkwood** North Dakota State University  
[matthew.kirkwood@ndsu.edu](mailto:matthew.kirkwood@ndsu.edu)

**Dominic Fischer** North Dakota State University  
[dominic.fischer@ndsu.edu](mailto:dominic.fischer@ndsu.edu)

The historic overlook shelter in Theodore Roosevelt National Park designed by landscape architect Weldon Gratton in 1935 affords a panoramic view of the rugged badlands river canyon and embodies the vision and design philosophy of his significant career. Gratton (1912 - 1990) is a relatively unknown landscape architect with links to early landscape planners Thomas Chalmers Vint and Herb Maier, whose work and vision is in need of preserving. The historical narrative of Gratton's career includes an early 1930s landscape architecture education at the University of Illinois Urbana-Champaign, collaboration with local ranchers, artists, and engineers, the design and construction administration of significant landscapes of the New Deal Era, a design philosophy connected to Yellowstone Park, and design innovations implemented in many U.S. National Parks and Seashores and the National Park System of India.

This research began with an essay connecting Gratton to the Theodore Roosevelt National Park master plan and identifying much of it as an Historic American Landscape in need of surveying. Field investigations coupled with historical and design analysis document a body of work worthy of a place in the annals of Landscape Architecture History (Historic American Landscape, HALS Survey). This paper explores Gratton's prolific work at Theodore Roosevelt National Park (then a Recreation Demonstration Area) through measured drawings, archival interviews and a design analysis of construction materials and methods and the elements of a master plan highlighting cultural and ecological significance. We focus on the overlook structure and the sandstone rock base designed in Gratton's words as "to appear growing of the pinnacle above" to contextualize and discuss his building legacy. The design was considered rustic style which was influenced by the Craftsman and the Prairie School.

The National Parks Service's approach for master planning was rustic design and landscape naturalization extended and benefitted the state's park system. The germination of Gratton's career in the North Dakota's badlands makes the findings of his influence all the more important, at a time when the panoramic views he framed so skillfully are being impacted by the discordant of natural gas flaring in the neighboring oil fields.

# From the PWA to Amy Poehler: The Rise of Recreation in Park Planning, 1930 to the present

**Heidi Hohmann** Iowa State University

In season one of Amy Poehler's TV comedy *Parks and Recreation*, Parks Director Leslie Knope dreams of building a park with a swimming pool, playground, tennis court, basketball court, football field and amphitheater—a veritable recreational mecca—on a tiny one-acre city lot. However exaggerated Poehler's TV version of parks and parks departments may be, her vision rings true in its emphasis on recreation. Active recreation emerged as key feature of municipal parks and “open space” systems in the 1960s, and continues to dominate park design today. This is in stark contrast to the late-19<sup>th</sup> century “romantic” or picturesque park, which emphasized the provision of “natural” scenery and passive forms of recreation, particularly for adults (Cranz 1982; Young 2004). The ascendancy of recreation was not solely a post World War II phenomenon, but rather had early roots in the 1930s, when New Deal programs such as the Public Works Administration and the Civilian Conservation Corps fueled the construction of hundreds of public landscapes across the United States (Cutler 1985; Carr 1998; McClelland 1998). Yet park construction was not the only outcome of this era. Equally important, but less well documented, was the concurrent upsurge comprehensive recreational planning. Building on the play movement of the early 1900s and the National Conference on Outdoor Recreation of 1924, federal planners affiliated with the National Park Service and the Land Planning Committee of National Planning Resources Board conducted a series of studies that culminated in the 1941 document, *A Study of the Park and Recreation Problem of the United States* and the “Park and Recreational Land Plan for the United States” it contained. This paper analyzes these 1930s planning activities to show how their recreational focus permanently shifted both social and professional perceptions of park landscapes, promulgating ideas that still define park practice and administration today. In particular, the paper examines 1930s classifications of recreation as physical, aesthetic, creative, intellectual, and social; and parks as primitive, modified, developed, and scientific (Department of the Interior 1937, 6). Such definitions re-conceptualized parks as places where the “recreation problem” would be solved, rather than as scenic environments that would spiritually calm or inspire. Parallel examples of federal and local parks illustrate how resultant changes in park typologies and administrative structures occurred at multiple scales of park design.

# Playfulness at Storm King

**Anne Godfrey** University of Oregon  
[godfrey@uoregon.edu](mailto:godfrey@uoregon.edu)

When sharing my plans to visit Storm King Art Center, south of Newburg NY, in the Hudson River Valley, with friends and family various responses settled in the area of: “Cool . . . um, why?” Perhaps it was my bland description “A large piece of private land with building sized sculptures strewn across it, you know by, like Andy Goldsworthy and Mark Di Survero?” Often my various short lists of artist solicited mild quizzical looks. “Ok . . .”

More surprising, colleagues, though more familiar with Storm King as a concept, were also somewhat unphased or at least unimpressed by the idea of my visit. Here’s why: we have all been witness to places with large sculpture strewn about that are essentially just big outdoor galleries. Instead of looking at art inside, I am looking at art outside (Walker Art Museum, the courtyard and roof of MoMA, various sites of Rodin collections such as in Philadelphia and at Stanford, the National Gallery, and even Olympic Sculpture Park). All the same gallery rules apply: quite observation, respectful decorum and the art placed into a fairly regulated and static setting (facilitating easy changes to the exhibited collection), and that is the end of it (Bennett 1995, Smith 2012).

Storm King is different. Instead, upon visiting the author witnessed a spontaneous license to play by people of all ages, walks of life and interests and was struck by this unspoken invitation to frolic. The author will explore this phenomena through a photographic narrative and discussion of the current design, supported by an outline of significant design choices and sculpture acquisitions made since Storm King’s opening in 1960 (Stern 2000, Beardsley 1985). This exploration will present some pertinent lessons to be learned, valuing the desire to play in designed landscape spaces as a positive agenda for design. These lessons can be applied to both “sculpture park” design and general design of landscape spaces.

A discussion of the usefulness of play for both adults and children will support the discussion as well (Bateson 2013, Russ 2014), focusing on concepts that encompass both exuberant and subtle forms of play based on the witnessed activities on site including: running, leaping, shouting, picnicking, laughing, singing, laying under/around/next to sculpture, cartwheeling, talking, kissing, touching, drinking, biking, napping, dancing, reading, lingering, exploring, and of course photographing.

# Formed by Water: Case of a Desert City in Iran

**Nastaran Tebyanian**

**Maziar Memar**

**Ron Henderson**

Traditional systems of managing and distributing water have historically played a vital role in formation and evolution of many rural and urban landscapes in Iranian Plateau. This is mainly because many cities have evolved on preceding agrarian landscapes that require irrigation due to insufficient precipitation. Traditional water division system of Semnan is one of the best surviving examples of such systems.

Semnan is located on the ancient Silk Road, on a narrow strip between Alborz massif and the central Kavir desert of Iran. The mountain range blocks the damp maritime air masses of Caspian Sea and causes an arid climate to its south. However, the same mountains are the main water source for the settlements. As in Semnan, water of a creek is distributed to create an oasis of about 15 square kilometers. This system is at least a millennium old and it has developed sophisticated physical and managerial mechanisms to respond to the different environmental and social needs and challenges.

Despite alterations and damages in recent decades, the system is still partially functioning and has potentials for finding solutions to the contemporary environmental and social problems. Before it is too late, its social and physical structure needs to be fully documented and studied, and to the extent possible preserved and its potentials utilized for future sustainable planning. Other than a valuable ethnographic research, many aspects of the system were not studied and are first explored in this paper.

This paper studies both the physical and cultural structures of the historical water division network in Semnan. It depicts the components of these two structures in three regional, city and neighborhood scales and shows the relation of the water network to urban form and fabric. The paper also studies the social mechanisms, the roles and rules through which the system was managed. The method of study is mixed archival and field study. We have used historical archives including a 15th century endowment document, historical census and monographic data, oldest aerial photos, as well as oral history and field study. The study provides insights for sustainable water management in arid climate, using vernacular social and environmental structures to facilitate people involvement in shaping urban landscapes and improve environmental justice.



# “History Made Visual”: Photography as a Lens for Richer Interpretations of Our Shifting Landscapes.

**Cynthia Mc Hone** Ball State University

[cmchone@bsu.edu](mailto:cmchone@bsu.edu)

Since Joseph Nicephore Niepce’s first permanent image from nature (circa 1826) and Nadar’s first captured aerial landscape image (1858), photographers have been forming and constructing landscapes. As photography became more accessible, design professionals began utilizing the medium in their design process. Landscape architecture programs throughout the United States have historically had students use photography as a tool for site inventory and analysis and graphic presentations. With the emergence of digital imagery and video, data has increased exponentially, yet the depth of understanding seems shallow. The wealth of contextual understanding of a place goes unseen.

JB Jackson stated that “Landscape is history made visible.” When do we start to see beyond the obvious and begin interpreting the hidden panorama of life? Memory of landscapes can be divided into what once was, what has vanished, and what we have yet to see. In *Landscape as Photography*, Estelle Jussim and Elizabeth Lindquist-Cock analyze and categorize photography in ways of seeing landscapes: Landscape as Artistic Gene, Landscape as God, Landscape as Fact, Landscape as Symbol, Landscape as Pure Form, Landscape as Popular Culture, Landscape as Concept, and Landscape as Politics and Propaganda. These categories hold true to the historical body of photographic work labeled as landscape photography. Landscape Architects can apply Lynchian design principles using these concepts and present a stronger framework to celebrate cultural history and recognize precedents within the development of today's modern landscapes. Matthew Potteiger’s writings about landscape narrative provide a rich way of looking at social and cultural contexts in how we have patterned a dialogue into the landscape. Combining the disciplines of photography and design theory allows landscape architects to develop a deeper understanding of the landscape. It also adds another photographic category to Jussim and Lindquist-Cock’s work: Landscape as Captured Stories—settings and verses held within a place and seizing the moment within a camera.

This presentation demonstrates how utilizing photography, design theory, and narratives as an analytical tool for mapping cultural shifts in norms and aesthetics upon the landscape intensifies visual awareness. Integrating these ideas into our landscape architecture classes encourages students to become photographic cartographers, developing greater understanding of

# Of Muddy Waters and Presidential Memorials: Erosion and Sedimentation in the Potomac River watershed

**Paul Kelsch** Virginia Tech (Alexandria)

[pkelsch@vt.edu](mailto:pkelsch@vt.edu)

This paper tells a history of erosion and sedimentation in the Potomac River basin in the nineteenth century. It describes deforestation and erosion due to settlement in the Shenandoah Valley, the largest area of cleared land in the watershed, and it chronicles the resultant sedimentation downstream in Washington, impacting navigation and commerce in the capital. George Perkins Marsh's "Man and Nature" (1864) identified these paired conditions as part of a long, historical pattern of human impact on the environment, and it galvanized the public, leading to well documented conservation of forestlands. Less documented is the response to the sediment that built up in cities and ports downstream.

This research specifically identifies the impacts of iron production in the Shenandoah Valley, a major source of erosion, and documents the sedimentation in Washington as evidenced in engineers' reports and historical maps. It then discusses reforestation efforts upstream, focusing on the creation of the George Washington National Forest (1912) on mountainous terrain surrounding the Shenandoah Valley. Reforestation was not simply a matter of natural succession but was a result of conscious management by the U.S. Forest Service and the Civilian Conservation Corps (1910s - 1930s). Downstream in Washington, efforts to dredge the sediment led to new land formation in the late 19<sup>th</sup> Century and an expanded National Mall planned by the McMillan Commission in 1902. The McMillan Commission Plan is best known for its baroque axes and neo-classical monuments, but often overlooked is a proposed forested island in the river, a foil to the baroque formality of the mall and the eventual site of the Theodore Roosevelt Memorial (1932). The island was reforested in the 1930s according to a plan by Frederick Law Olmsted, Jr., making a small natural respite in the heart of the capital as a memorial to Roosevelt, best known for his conservation agenda and wilderness exploration.

In order to link the efforts upstream and in the capital, this history is broad in scope but focuses on specific landscapes that illustrate two major themes. One is the positive impact of human agency in countering environmental degradation – an agency assumed by Marsh himself, but one that has been overlooked in later environmental rhetoric. The other is the consecration of these forests as presidential memorials, symbols of the nation that can be read as evidence of the rise in stature of forests in America yet reflect the often-ambiguous relationships we have with nature.

# A Review of Crime Prevention Through Environmental Design Studies in China, 1985-2015

**Jingjing Wang** Beijing Forestry University

**Sean E. Michael** Utah State University

**Jianning Zhu** Beijing Forestry University

Since its emergence in the 1970's, a wealth of studies related to crime prevention through environmental design (CPTED) have been conducted in North America and the United Kingdom. In contrast, little attention has been paid to this field by Chinese scholars. However, the rapid pace of China's urbanization continues to pose challenges for its public safety system—increasing crime rates have emerged as an urgent problem to be solved. If advancements in environmental criminology do not constitute an element in those solutions, a proven strategy of Western law enforcement and design disciplines will have been lost.

The reasons behind why this area of study has been neglected by Chinese scholars are simple, while the solutions may be complex. Besides personal scholarly interests, few Chinese landscape architects or planners have made inroads into this field because of the difficulty of accessing sufficient crime data without first obtaining governmental clearances and authorization. Understanding the extent to which CPTED, and environmental criminology more broadly, has reached design audiences in China is the first step in understanding the gap between them and their colleagues elsewhere. As with all nations, police are grossly outnumbered in dense urban population centers, and face great difficulty in thwarting criminals. In China as elsewhere, omnipresent crime prevention strategies offer one strategy for this dilemma.

This paper provides an overview of how crime prevention has emerged and evolved in China, along with what currently constitutes the 'state of science' in China. An analysis of publications pertaining to CPTED over the last 30 years in China is presented, having been identified by the top three Chinese academic search engines. This research analyzes the collected papers from different aspects, such as numbers of papers from different time or of different research topic. The paper focuses on how deep analysis these papers are, what are the study trends and what themes the scholars tended to choose of the papers. Results have been divided into three categories: theories of the relationship between crime prevention and space; studies of crime distribution; and studies of crime prevention policy plus case studies of strategy implementations. Results are summarized, along with suggestions for future research and dissemination in China.

# Materiality of the American Modernists: how material experimentation helped shape a new style

**C. Timothy Baird** Pennsylvania State University

[ctb3@psu.edu](mailto:ctb3@psu.edu)

From aluminum to concrete, Modernist American landscape architects followed in the footsteps of Fletcher Steele and the French Modernists by exploring materiality, an integral component of their design process. Expanding the boundaries of the material palette played a crucial role in shaping the field and changing its direction. The use of new industrial materials by landscape architects helped to define a distinct Modern style as one that consisted of more than just plants. The goal of this research is to describe the influences, inspiration, and sources of designer's ideas that became the foundation for their material selections, juxtapositions, and assemblies as a key component of their design process, context, and design intent. Landscape materiality will be positioned as a reflection of context, culture, aesthetics, heightened user experience, and imbued meaning.

Both Dan Kiley and Garrett Eckbo were very impressed by Fletcher Steele's work and Kiley felt that he was the only "good designer of the 1920s and 30s." They both were drawn to his work because he was an "experimenter" and one who was not bound by the strictures of the "rules" of symmetry, the axial organization of the Beaux Arts School, or the neo classical forms being used by others at the time. This experimentation was not only in the formal arrangement and the spatial volumes he created but also in his use of materials. This gave Thomas Church and Robert Royston, as well as Kiley and Eckbo, the confidence to experiment with their own material palette. Steele had gleaned the value of material exploration from the French Modernists through his travels, information he disseminated in several articles he wrote for *The House Beautiful* and *Landscape Architecture Quarterly*. These articles heavily influenced the emerging American Modernist movement in landscape architecture. Steele's use of the reflective surface can arguably be attributed to the Vera brothers' *Jardin Noailles* while his use of anthracite coal in the garden at Naumkeag likely comes from his own desire to expand material boundaries, surely reinforced by what he had seen in Modern French gardens.

This presentation will review material innovations that followed the work of Steele and the French, such as Eckbo's *Alcoa Forecast Garden*, Royston's experiments in colored concrete pavements, and Haag's use of corn syrup to create concrete finishes as a way of situating the work as direct descendants of Steele, Andre and Paul Vera, Legrain, Guevrekian, and Mallet-Stevens. It will be argued that this work forms the theoretical and conceptual foundation of today's explosion in material innovation.

# Rise and Decline of Skateboard Parks in South Korea

**Han, Soyoung** Virginia Tech  
[syhan@vt.edu](mailto:syhan@vt.edu)

**Kim, Mintai** Virginia Tech  
[mkim07@vt.edu](mailto:mkim07@vt.edu)

The main purpose of this study is to examine the process of birth, development, and decline of a sports space in Korean urban parks focusing on skateboard parks. The popularity of skateboarding in Korea led to construction of many skateboard parks, but as their popularity waned, these parks have been abandoned. This study identifies some of the problems associated with designing, developing, and operating skateboarding spaces in urban parks and suggests ways to solve these problems. Using a discourse analysis method, the authors extracted the contents of newspaper articles on the adoption of skateboard culture and the construction of skateboard parks, and then examined the factors that have led to the creation and decline of such spaces.

The process through which skateboarding secured spaces in urban parks in South Korea consists of three steps. First, there was an agreement between skateboarders and park managers that parks are the proper place for skateboarding. Second, when it was possible to create comprehensive spaces for skateboarding, skateboard parks were built in large numbers. Third, new cities competed with each other to bring in new sports parks as a means boosting the local economy. This led to the spread of skateboard parks.

The study also identified several factors that have contributed to the decline of these parks. First, where there were conflicts over the occupation of a space among various interests, the skateboard parks have been closed. Second, if park facilities were not able to accommodate the needs of users (e.g., if they were only for large skateboarding events), those facilities served only as temporary places for skateboarding. Third, there has been little support for cultivating professional skateboarders who would continue to use the large-scale facilities, while recreational skateboarders have switched to other activities. All the above factors have served to make people not interested in securing skateboard-specific space.

This study was designed to examine the processes through which sports activities such as skateboarding are accommodated and the development of such activities in parks. By doing so, this study discovered the various roles, values, and ideology that parks should bear in the future. The planning of the urban parks might be considered to embrace the flexible and fragile nature of the urban parks as the public space. These research implications will guide the thoughtful design and management of the urban parks.

# Tiny chapels everywhere: The Imperios of the Azores

**Benjamin H. George** Utah State University  
[benjamin.george@usu.edu](mailto:benjamin.george@usu.edu)

**Ole R. Sleipness** Utah State University  
[ole.sleipness@usu.edu](mailto:ole.sleipness@usu.edu)

The Azores are composed of an archipelago of nine volcanic islands in the middle of the Atlantic Ocean. These Portuguese islands have been at the crossroads of oceanic transit for six centuries and, as a result, have been influenced by waves of ideas and beliefs, carried to the islands by explorers, travelers, conquerors, and immigrants. While sitting at this crossroad of ideas, the isolation of the islands has also acted as an insulator, where traditions can not only survive, but flourish. Such is the case of the cult of the Holy Spirit, a Catholic sub-culture which has at its center the celebration of a religious festival surrounding the Day of the Pentecost.

While the celebration occurs throughout the individual villages, the symbolic center of the festival occurs within small chapels, called Imperios. Nearly every village has an Imperio, which often feature ornate and garishly painted facades. The Imperios are special built structures, meant to be used only during the festival, yet they stand as an important structure throughout the rest of the year for the community by providing a vernacular identity and landmark in the landscape of each village.

This research examined three aspects of the Imperios in the Azores. First, an analysis of the placement of the Imperios within the village was undertaken to identify common factors in the siting of the chapel in regards to their position as landmarks. Second, the facades of the Imperios were analyzed to create a typology based on structural and regional factors and the creation of geographic areas of shared identity within the archipelago. Third, the Imperios were assessed as a means of branding for these rural communities, and for the Azores in general. The findings of the research demonstrate the centrality of the Imperio to Azorean culture, a centrality that is reinforced by the central siting of the chapels and the branding of the Imperios as a means for a village to establish a unique identity while simultaneously participating in a larger shared Azorean identity.

# The Fayetteville Street Pedestrian Mall: Dissolution of Public Space.

**Nicholas Serrano** North Carolina State University

This paper examines the Fayetteville Street Pedestrian Mall in Raleigh, North Carolina, as a case study on the promises and politics of public space in post-war consumer culture. It argues that the pedestrian mall was an effort to regulate public space and create public policies of racial segregation imbedded in the modern urban landscape. Downtown Raleigh suffered widespread disinvestment in the wake of post-war suburbanization as the city grew towards the rapidly developing Research Triangle Park. Municipal leaders sought to revitalize the central business district through a trio of public projects including a new convention center and State Capitol complex connected by the Fayetteville Street Mall. They hoped closing the street to traffic and creating a pedestrian space would entice suburban shoppers back downtown and return Main Street to economic and cultural prominence.

This paper situates the city's desire to recreate a vibrant central business district in the context of a socially conservative southern community through the perspective of historical materialism. It argues that the Fayetteville Street Mall functioned as an architecture of silence hidden behind a spectacle of consumption. In the 1950s and 60s, civil rights protests created an image of downtown associated with civil disobedience and social disorder that played into the public imagination of urban decay. Redevelopment of Fayetteville Street was part of a larger effort by municipal leaders to control the central business district and buffer it from neighboring black communities. Legalized segregation of the Jim Crow era would be perpetuated in the spatial segregation of post-war urban economics and public policy.

The Fayetteville Street Mall was part of a larger agenda of urban renewal to identify downtown as a modern center of commerce and leisure. Linking the new Capitol complex with the convention center, the mall posited retail as the physical and metaphorical connection between political power and civic life. The Fayetteville Street Mall was modeled on an ideal image of pedestrian life that functioned to devolve public space into a theater of consumer culture. Ultimately the paper seeks to understand how the downtown pedestrian mall aestheticized the privatization of public space while distracting from underlying politics of social segregation.

# Vernacular Minimalism: a 21<sup>st</sup> century design approach

Mary Padua Clemson University  
[mgpadua@clemson.edu](mailto:mgpadua@clemson.edu)

This paper investigates the notion of vernacular minimalism, an emergent design genre represented in the 21<sup>st</sup> century works built by contemporary landscape architects, Tom Leader (2014), Roberto Rovira (2015) and Kongjian Yu (2015). It builds from the evolution of minimalism (Levy 1996) that has been largely practiced and represented in works by modern landscape architects like Peter Walker. The three landscape architects featured are geographically situated in California, Florida and China, yet their works draw from the “local” (vernacular) and are inspired by the minimalist approach. The term, vernacular, is largely understood by some as the “un-designed” (Jackson 1986) or “everyday” (Crawford & Chase 1999). In this research, that is praxis-based and appropriating from Meyer (1997), the interpretation of vernacular is expanded. It serves as a qualifier to describe a new design genre when combined with minimalism for a term I have coined “vernacular minimalism”. The method of inquiry is interpretative (Swaffield 2002), exploratory, speculative and preliminary. It evolves from the trajectory and mode of design criticism, history and theory espoused by Jencks (1987), Meyer (1997), Crawford (1999), Treib (1995), and others. This new design genre, vernacular minimalism, is analyzed through a close reading of works by three landscape architects; it is characterized by their multivalent references to local culture, materiality and technology, ecological processes and the site’s geomorphology. It also inherently touches on their values, philosophies and inspirations derived from their close readings of sites under investigation. Vernacular in this application draws from the use of local materials, interpretation of local culture and the site’s memory. Vernacular minimalism expands from the formal aesthetic tradition of minimalism and takes into account the landscape architects’ understanding of their impacts on the site’s ecology and visual quality. As an initial and preliminary narrative and interpretative discourse, this paper is intended to generate discussion about the emergent new design genre and aesthetics, as well as provoke discussion about the agency of design criticism for theory-building that is praxis-based and advances landscape architecture.



# Parsing the Complex Pastoral

**Meg Studer** City College of New York  
[studer@siteations.com](mailto:studer@siteations.com)

Henry David Thoreau's *Walden, or Life in the Woods* (1846-54) is typically read by landscape students as part of the preservationist canon (Thoreau, 2004). Whether offered as exemplifying romantic, individuating immersion or complex, pastoral pastiche, this introduction is largely done through a literary lens. From Leo Marx to Timothy Morton, critics have focused on the manipulation of poetic forms, tactile affects, and Georgic tropes – such as seasonal cycles, agrarian ease, and transhumance withdrawal – in Thoreau's critique of American industrialization (Marx, 1964; Morton, 2009).

While providing a sound foundation, such texts neglect the wider array of publications – almanacs, state statistics, and commercial logs – parodied in Thoreau's acerbic accounting; They miss the tabulations directly connecting *Walden's* ascetic encounters with territorial management. Taking an expanded view, my project, “Parsing the Complex Pastoral,” thus starts from the historic overlap in the representational tools of political arithmetic, political economy, and pastoral polemic (Di Palma, 2014; De Bruyn, 2004; Porter, 1986), and explores the quantitative indices of ‘improvement’ driving Thoreau's critique.

As a case study, “Parsing...” compares the energy crisis evoked in both *Walden's* “House Warming” and the contemporaneous *Statistics of...Industry in Massachusetts* (Palfrey, 1846). First, with an interactive narrative, I will situate Thoreau's administrative allusions and examine the proliferation and impact of such statistics – as inherited governmental instruments, resource projections, indices of market geographies, and ideological artifacts. Second, with database-driven map-queries, I will demonstrate how the tools of design and the digital humanities can enable students to actively engage and extrapolate upon the economic and environmental problematics of *Walden*. In short, “Parsing...” makes visible the distributed systems, global markets, and consumptive up-scaling implied in Thoreau's parodies, but largely excluded from his intimate material encounters.

In grafting contemporary data-visualization techniques, my aspiration is that students' encounter with Thoreau acts as a prompt to reflect on landscape's contemporary engagement with resource accounting and environmental metrics: their evolving forms, generative procedures, and scales of implementation and impact. Instead of a simple preservation polemic, *Walden* thus becomes a means to historicize and foster a nuanced, critical, and cultural engagement of quantitative literacy in landscape.

# LANDSCAPE PERFORMANCE



# Integrating Life-Cycle Costs with Landscape Performance: Cost Comparison and Cost-Benefit Analysis

**Yi Luo** Texas Tech University

**Ming-Han Li** Texas A&M University

Landscape performance is a concept that Landscape Architecture Foundation (LAF) raised in 2010. It attempts to evaluate the outcomes of built landscape projects and quantify created benefits in the environmental, economic, and social aspects of sustainability. The significance of landscape performance research is that it collects evidence to assess design solutions, reduce uncertainties during decision making, and promotes measurable sustainable design practices. As introduced, landscape performance is an emerging research area in landscape architecture. Its theoretical framework is still being discussed and updated. Current landscape performance framework does not fully consider the costs of performance benefits. Benefits are not generated for free, and the costs of benefits are important for decision making. Cost in landscape performance quantification not only allows cost comparison between conventional and sustainable solutions, but also facilitates cost-benefit analysis of sustainable solutions.

The purpose of this study is two-fold. First, it creates an updated framework to include cost in landscape performance quantification. Second, it explores credible methods of monetizing non-market landscape performance benefits to help with the cost-benefit comparison of sustainable solutions.

The research was conducted in three steps. First, we reviewed literature regarding life-cycle cost and adopted a framework to refine the current landscape performance framework. Second, we used a master planned development in a landscape performance case study – Cross Creek Ranch, conducted by Li et al. (2013) to demonstrate how to calculate landscape solutions' life-cycle costs and how to report cost-embedded benefits. Lastly, we extracted reliable methods of valuing non-market ecosystem services from the literature and discussed their possibility of monetizing landscape performance benefits, which will facilitate cost-benefit analysis and help designers and clients make decisions.

The results show that life-cycle cost by the present worth or annualized methods (Kirk, 1995) can be integrated into the framework of landscape performance. The representation of cost can be combined with benefit using efficiency and productivity metrics. Due to the difficulty in determining dollar value of many environmental and social benefits, costs of sustainable solutions seem higher than benefits in many cases. We suggest adopting the eight proven ecosystem evaluation methods – avoided costs, market methods, replacement cost, travel cost, production approaches, hedonic pricing, contingent valuation and conjoint analysis (Farber et al., 2006; Twill et al., 2011) – in the literature to help estimate the value of non-market landscape performance benefits.

# Measuring the Social Performance of Food Production Landscapes: Towards Establishing a Framework & Metrics

**Ellen Burke** Cal Poly San Luis Obispo

[eburke02@calpoly.edu](mailto:eburke02@calpoly.edu)

Advocates of integrating food production landscapes within urban, suburban, campus and other design typologies cite multiple and integrated benefits of food landscapes. These include enhanced food security and quality; land access for small farmers; psychological and social benefits such as community building; educational opportunities for environmental, health and nutrition issues; and green infrastructure contributions, among others (Philips 2013; Ackerman 2012; Hodgson et al 2011; Hou et al 2009; SAGE 2005).

If performance can be understood as “the fulfilment of a claim, promise, request” (Merriam Webster 2015), then landscape performance measures for food production would ideally encompass the overall range of cited goals and benefits. Yet in current practice the performance of food production landscapes tends to be measured in limited ways, most often by weight of harvest and/or consumer value of harvest. One reason that designers privilege these measures is the availability of online calculators that estimate yields by weight and consumer price equivalent, and a concurrent lack of easily accessed metrics for other benefits. While measuring performance by weight and consumer value may be appropriate in some cases, there are several drawbacks with this approach, including undervaluing other outcomes.

This paper examines potential metrics for evaluating the social performance of food production landscapes and generates recommendations for assessment methods. Criteria from the Landscape Architecture Foundation (LAF) case studies on the social performance of landscape guide the scope, organization and critique of relevant literature across diverse fields, including nutrition, epidemiology, geography, planning, and landscape architecture. This paper builds a framework which improves the link between performance assessments and desired social outcomes, positions food production landscapes as complex and regenerative eco-social systems, and suggests methods for assessing performance across the range of benefits produced.

## Seven years in the making: Research insights into green roof design that will enhance performance and promote applications throughout the industry.

**Kevin Krogulecki** Michigan State University  
[krogule2@msu.edu](mailto:krogule2@msu.edu)

**Erik Cronk** Michigan State University  
[cronkeri@msu.edu](mailto:cronkeri@msu.edu)

**Joanne Westphal** Michigan State University  
[westphal@msu.edu](mailto:westphal@msu.edu)

This paper will present a synopsis of five research projects that examined biodiversity, storm water mitigation, water quality enhancement, and microclimate conditions surrounding different types of green roof systems under different structural conditions. The studies were part of five masters theses in Landscape Architecture.

Two projects addressed the inherent characteristics of different green roof systems (extensive, semi-intensive or intensive) to support bird or insect populations in Michigan and Illinois urban areas. Findings reveal that biodiversity is significantly increased on green roof systems where a mix of grass, sedum and herbaceous materials creates complex habitat for a variety of songbird and insect species. In general, the greater the complexity of plant species in a green roof system, the higher the biodiversity. Intervening variables like physical connections of the roof to the street will have a major effect on species composition and numbers, for both birds and insects.

Two other projects involved comparisons of five different roof surfaces (sedum, grass & bare soil with 6" extensive soil systems, fiberglass shingles & steel shingles) on slopes typical of Midwest residential structures in attempt to differentiate storm water retention and water quality potential. Storm water surges and peak flows were significantly higher on the non-living, sloped roof systems, whereas, grass covered green roofs systems were the most effective in reducing nearly 70% of total rainfall following high intensity rain events while simultaneously slowing peak flow. Storm water quality, however, was actually diminished in green roof run-off due to the release of organic matter, resulting in discolored water, increased water turbidity and dissolved phosphate and nitrogen compounds compared to traditional roof systems. These findings encourage the use of secondary catchment or filtration of green roof runoff that can be part of larger sustainable site storm water management systems.

The last project examined the microclimate conditions occurring on a very steep (43%) semi-extensive sedum green roof system oriented on an east-west axis. This study found that direct (south roof aspect) versus indirect (north roof aspect) solar incidence can affect the ambient temperature by as much as 22° Celsius, and that overtime, microclimate conditions on steep south roof aspects will create unfavorable conditions for the most drought tolerant green roof plant materials. This study suggests that some type of physical intervention, involving a combination of shade and/or irrigation may be necessary if green roof systems are to achieve optimal performance on steep roof buildings.

# Desert Green Roof Performance: Opportunities and obstacles to mitigate stormwater flooding and urban heat islands in Arizona

**Paul Coseo** Arizona State University  
[pcoseo@asu.edu](mailto:pcoseo@asu.edu)

The goal of this study is to evaluate green roof plant performance for mitigating stormwater runoff and urban heat islands in hot arid climates. Green roofs are vegetated roofs used to capture and clean stormwater, reduce urban heat islands, improve energy efficiency, and enhance urban ecology (Dvorak and Volder, 2010; EPA, 2012). This study is important because green roof systems have not been extensively researched in all types of bioclimates, particularly arid and semi-arid climates (Dvorak and Volder, 2010). Dvorak and Volder (2010) reviewed 28 articles on green roofs in North American by ecoregion from 1998-2007. They found only one article (Dewey et al., 2004) examined green roofs in semi-arid conditions (Salt Lake City). According to the Web of Science, journals or conferences have published only four “arid” green roof articles and two were “Phoenix” articles (Sailor et al., 2012; Nagengast et al., 2013). Yet, both of these studies were based on model simulations and did not examine laboratory or in-situ green roof performance in hot arid conditions. This lack of knowledge on green roof performance in hot arid conditions limits our ability to understand opportunities and obstacles to their application in such environments. This six-month study (June-December 2015) was located on a roof at Arizona State University. I used a case-control experimental design to examine how the performance of three GreenGrid semi-intensive green roof plots (6' x 8' x 8") with xeric plant material differed from a conventional white roof plot (6' x 8"). Each of the three green roof plots had identical soil, plant material, and only differed in irrigation applications (high, moderate, and low). I use bivariate and regression analysis to examine plant performance and how the green roof impacts stormwater quantity and thermal contribution compared to the white roof. The health of plant material was evaluated using a method similar to Butler and Orians (2011). I deployed two rain gauges and large buckets to capture runoff quantity from each of the four tables similar to Coffman (2007). I used a thermal camera and other weather equipment similar to Klein and Coffman (2015) and Oke (2004). This research provides a better understanding of the opportunities and obstacles for green roof systems to reduce stormwater runoff and urban heat islands in hot arid climates. Lessons learned will have implications for sustainable development efforts in other rapidly urbanizing arid regions around the globe.

# Green infrastructure design for stormwater quality and climate change resilience: Monitoring and modeling study in a semiarid environment

**Bo Yang** Utah State University

**Shujuan Li** Utah State University

**Hailey Wall** Utah State University

**Pamela Blackmore** Utah State University

**Grant Hardy** Utah State University

**John Locke** Utah State University

This study examines the performance benefits and climate change resilience of green infrastructure (GI) design implemented in Daybreak, a 4,100-acre master-planned community in South Jordan, Utah. GI techniques are extensively used for on-site stormwater management in the form of natural drainage bioswales, canals, dry wells, constructed wetlands, and infiltration trenches. These techniques retain 100 percent of stormwater that falls on-site for up to a 100-year storm event. An ongoing stormwater monitoring study is assessing the hydrologic performance of the Daybreak system. Streamflow data are collected by ISCO 750 flow meters, and precipitation data are collected by a Texas Electronics tipping bucket rain gauge on-site. The objectives are (1) to develop an U.S. Environmental Protection Agency's StormWater Management Model (SWMM) for the Daybreak GI system, and (2) to simulate climate change resilience of this GI system. Climate change resilience is measured by the robustness of stormwater runoff outputs given the variations in precipitation and temperature due to climate change. The analysis is conducted using observed stormwater runoff and water quality data from field work coupled with SWMM modeling analysis. Stormwater data and land use/land cover information are used to develop the SWMM model. Parcel data are used to assess the extent of development in the Daybreak watershed. Field work has been conducted to assess the built conditions of stormwater facilities (e.g., detention/retention pond, wetland, dry well) in comparison with the construction documents. In addition, ground truth has been done through a visual assessment of the depth of the detention and retention facilities and the overall health of vegetation within them. Five different climate scenarios are developed based on simulations of global climate models produced for the Fourth Assessment Report of the Intergovernmental Panel on Climate Change, which include variables for temperature and annual precipitation. In response to these imposed external changes of climate variations, the SWMM model simulates new watershed outputs (e.g., streamflow). The parameters for Manning's N and depression storage are determined in SWMM, such as the "N Imperv" and "N Perv" parameters for overland flow over the impervious and pervious portion of the sub basins, respectively. This paper reports preliminary results of the study in which observed runoff quantity data are used to calibrate and validate the SWMM model. This longitudinal modeling study (2015-2030) can be instrumental for predicting climate change resilience and landscape performance of future GI developments in a semiarid environment.

# Analyzing Long-Term Benefits of Stormwater Policies

**Cory Gallo** Mississippi State University  
[Wcg59@msstate.edu](mailto:Wcg59@msstate.edu)

**Stephanie Sigman** Mississippi State University  
[sjs208@msstate.edu](mailto:sjs208@msstate.edu)

Without stormwater management, development can erode streams, cause flooding, and prevent groundwater recharge. On the other hand, managing stormwater can keep cities livable while improving watershed health. Implementing requirements through a stormwater ordinance protects water resources, provides benefits to humans and wildlife, promotes recreational resources, and safeguards drinking water. Land can be improved as it is developed or redeveloped if an ordinance is in place to protect its environmental benefit (Center for Watershed Protection, 2008). Municipalities tend to develop stormwater policies by examining those of their neighboring communities and modifying them to fit their own needs. Unfortunately, most choose policies out of convenience and perception of similarity rather than a purposeful, directed search. They tend to look at well-recognized programs such as Portland and Seattle or for other municipalities with similar politics regardless if the program is of high quality or relevant to their environment (Debo and Reese, 2003; EPA, 2012)). Alternatively, having a policy that is confirmed through science creates regulations that decision makers can confidently support, limiting opposition from developers and landowners. Transforming complex science into a necessarily simple policy is vital for a successful stormwater management program.

To address this issue, a dynamic simulation model was developed which incorporates local rainfall and development data and utilizes the SCS Runoff Curve Number Method to analyze stormwater runoff volume for various storm events. To test the model, a pilot study was undertaken which uses one year of development data from Chattanooga, Tennessee. However, the model can be widely applied if modified to an individual city's climate and development data. The values calculated are then used to analyze several combinations of applicability thresholds, detention requirement, and water quality management in order to represent different policy choices, which can vary depending on the community's desired goal. Possible choices include assessing current policies, considering encouragement of development in certain zones, or addressing redevelopment versus new development and greenfield development versus brownfield development. This study shows that a quantitative analysis of a stormwater policy can help inform policy makers on how to balance economic development, administrative resources, and protection of water resources. It also elucidates which combination of policy components will be successful in addressing local conditions and stormwater goals. The model has the ability to influence the policy-making process and, ultimately, is capable of providing a policy that is credibly tested and understood for its potential to protect the city's watersheds.



# The Social Preference for Landscape Performance: A Case study of 4 Chinese Urban Parks

**Yang Yang** South China University of Technology

[yangyy1a@outlook.com](mailto:yangyy1a@outlook.com)

**Guangsi Lin** South China University of Technology

[asilin@126.com](mailto:asilin@126.com)

**Honghong Zhao** South China University of Technology

[arhhzhao@scut.edu.cn](mailto:arhhzhao@scut.edu.cn)

Though sustainable landscape design commonly seeks to achieve a balance between environmental, economic, and social benefits, yet the preferences towards the three benefits may vary in different cultures or societies. The paper discusses the rationale of such social preference so as to fully understand how nations develop sustainable landscape in relation to various models of environment-economy relationship.

Following the literature review, this research is a comparative study of the landscape performance of four model urban parks in China cited in the Case Study Briefs (CSB), including Beijing Olympic Forest Park(2012), Tianjin Qiaoyuan Park(2012), Tangshan Nanhu Eco-city Central Park(2011), and Shanghai Houtan Park(2011) (published by Landscape Architecture Foundation (LAF) in its Case Study Investigation (CSI) program). The specific studies are divided into three aspects: 1) within different social context, select 4 American cases from CSB similar with these China's cases in scale and type, comparing their performance characteristics; 2) within the same social context, take an analogical study on the performance characteristics between the 4 China's cases; 3) for each of these cases, compare the preliminary design strategies and goals with the performance results. Then the study comes to a conclusion about the social preferences for landscape performance of the cases. Finally, in terms of Chinese culture, economy-ecology problem, policy making, public participation, the study discusses the fundamental influences of landscape performance preferences.

Our study shows that, in the last decade, China's urban park projects comparatively prefer ecological benefits to sociological and economic benefits. Such social preference is affected by the following factors; (1) The pro-ecological tradition of Chinese garden culture enables landscape architects and the public to accept the idea of ecological landscape construction. (2) With rapid urbanization, China is going through an unprecedented ecological crisis and the urban green space plays an increasingly significant role in ecological restoration and construction. (3) As state-sponsored infrastructure, China's urban parks are less market-oriented. Therefore, these projects take little account of cost-profit balance and other potential economic benefits. (4) Since China's landscape projects are often funded and managed by the government, and mass participation in landscape design is limited, the public have lower expectations of social activities with less concern about social benefits.

This study shows how social preferences considerably affect landscape performance in contemporary China and relevant problems in China's landscape industry, and points the landscape performance shall move towards an optimum solution to the balance among various benefits achieved by sustainable landscape.

# The Role of Landscape Performance in Standardized Landscape Architecture Curricula

**Arianna Koudounas** Landscape Architecture Foundation  
[akoudounas@lafoundation.org](mailto:akoudounas@lafoundation.org)

**Andrew Fox** North Carolina State University

**Emily McCoy** Andropogon/North Carolina State University

**Kenneth Brooks** Arizona State University

**Stephanie Rolley** Kansas State University

As landscape architects continue to study the connections between landscape and the health of ecosystems, people, and economies, the profession increases its understanding and collective capacity to achieve environmental, social, and economic sustainability. Likewise, as the body of knowledge related to landscape performance grows, it will inform public policy, reduce investor risk, and improve return on investment. Services such as these, in addition to others, enable landscape architects to fulfill their mandate to protect the health, safety, and welfare of the public. In this way, the need to weave landscape performance into the education of every landscape architecture student becomes evident.

Landscape performance can be defined as a measure of the effectiveness with which landscape solutions fulfill their intended purpose and contribute to sustainability. By embracing performance measures and evaluating the performance of built projects, landscape architects can elevate the quality of designed and planned landscapes. This transformation in the profession begins through education. In today's increasingly evidence-based marketplace, landscape architecture students need to be able to convey the environmental, economic, experiential, and social value of excellent design. Incorporating landscape performance into landscape architecture education will give students the awareness and skills they need to design for, evaluate, and communicate the impact of their projects.

Programs such as the Landscape Architecture Foundation's (LAF) *Landscape Performance Series* (LPS), *Resources for Educators*, and *Case Study Investigation* (CSI) programs have been developed to build capacity to achieve sustainability and transform the way landscape is considered in the design and development process. LAF's Landscape Performance Education Grants (LPEG) also support diverse pedagogic strategies and learning outcomes that advance performance-based design education. Through their delivery, these programs connect both students and faculty to information and innovations from research, industry, academia, and professional practice.

This panel will focus on lessons learned from various LAF programs and courses developed specifically to teach landscape performance, and discuss ideas and implications related to the integration, and possible standardization, of landscape performance into the curricula of accredited landscape architecture programs. The structure of the panel will include a LAF program administrator, a representative from an industry-leading firm that specializes in the development and assessment of high-performing landscapes, and three landscape architecture faculty members who have participated in various LAF sponsored programs and teach courses focused on landscape performance.

# Depicting Sustainability: Infographics Tell the Story of Daybreak's Landscape Performance

**Ekpanith Jom Naknakorn** Design Workshop Inc  
[jnakkorn@designworkshop.com](mailto:jnaknakorn@designworkshop.com)

Using visually compelling infographics, this poster will illustrate the metrics used to evaluate the environmental, economic and social performance of Daybreak, new planned community in South Jordan, Utah. Narratives, graphs and tables can only partially describe a project. Infographics are powerful visual tools that can, in an instant, communicate landscape performance before and after implementation. The infographics shared in this poster will serve as a valuable reference for academic and professional practice.

The 4,200-acre Daybreak development transformed the historic toxic landscape of the Bingham Copper Mine into a sustainable community. The fundamental design challenge required solving the way stormwater was managed and convincing community and municipal agencies to adopt more sustainable approaches. Today, Daybreak's parks and open space system forms an integrated network of natural and cultural systems that are the center of community life.

The planning, design and implementation of Daybreak followed a sustainability agenda with four areas of focus: environment, community, economics and art. This poster will tell a graphic story of the project's sustainable goals and strategies, the key metrics used to evaluate its performance, and the assessment of its built outcome.

- Environmental metrics include stormwater quantity and quality; water conservation; area of constructed wetlands; habitat creation; auto trip reduction along with fuel savings and carbon emission reduction; amount of native and drought-tolerant plants; and on-site material recycling and reuse.
- Social metrics include area devoted to parks and open space; amount of maintained trails; area devoted to public gathering spaces; percent of children that walk to school; mix of uses with unit and square foot measures for residential and commercial space; four-season programming of community spaces; and demonstration gardens that teach residents about native species and responsible landscape methods.
- Economic metrics include cost savings due to stormwater management methods; cost savings due to water conservation; and materials and hauling cost savings due to on-site reuse of waste rock.

This poster will summarize Daybreak's environmental, social and economic performance based on a Landscape Architecture Foundation-funded case study by Utah State University Associate Professor Bo Yang. The infographics specially developed for this poster will graphically depict the metrics included in the case study and supplement the research of this academic team.

Developers, designers and communities must solve complex economic, social and environmental problems with sustainable strategies. The poster will illustrate the sustainability agenda for Daybreak community through compelling metrics graphics that visually depict the community's landscape performance.

# Evaluating Performance of Campus-based Agriculture: Is Bigger Better?

**D. Scott Douglas** University of Illinois at Urbana-Champaign  
[dsdougl2@illinois.edu](mailto:dsdougl2@illinois.edu)

**M. Elen Deming** University of Illinois at Urbana-Champaign  
[medeming@illinois.edu](mailto:medeming@illinois.edu)

On-campus farming...weekly farmers markets... hundreds of student farmers... more than a ton of produce harvested. These ideas are not out of place describing the results of a student farm program at a 1,783-acre agriculturally focused land-grant university like the University of Illinois at Urbana-Champaign (UIUC). But what about an urban campus with a total footprint of only 32 acres? How does Loyola University Chicago—a campus located at the north end of the famed Lake Shore Drive in downtown Chicago—manage to marshal its student, faculty, and physical resources to create a high-performing, productive urban farm? The performance of the urban farming program at Loyola was a noteworthy component of a landscape performance case study undertaken for the Landscape Architecture Foundation's 2015 Case Study Investigation Program, and its productivity prompted the research team to wonder how Loyola's program would compare to the larger student farming operation at UIUC. This ongoing comparative case study examines the student farming programs at both campuses in order to assess whether the small-scale urban farming at Loyola (0.33 acres) is more or less efficient and productive than the larger-scale program at UIUC (6.23 acres). Loyola's collection of small, previously underutilized parcels of land throughout campus include vacant lots and one green-roof. How can this compete with UIUC's large agricultural district and its collection of contiguous fields, located 1.2 miles south of the main campus, looking more like a conventional truck farming facility? For this study, productivity is evaluated in terms of pounds of produce harvested and revenue generated through the sale of that produce. Those values are compared directly and on a per square foot basis using production data provided by the program managers. Interviews with student workers and faculty/staff advisors are analyzed to identify key themes that are either shared by or distinguish the two programs. These will include observations on crops suitable for different growing environments, technological resources, and labor/management regimes most suitable for student workers. The results of the study will begin to identify best practices that offer multiple benefits for contemporary colleges and universities: work-study programs that teach techniques for sustainability as well as small-scale agriculture; savings on money and energy; better (fresher, local, secure) food supply for the student body; and increased interest and enthusiasm in the environmental arts and landscape architecture (an intangible aspect of high performance landscapes that is difficult to quantify).

# A Strategic Concept of Multiple Objective Ecological Optimization in Rural Landscape Planning and Design in Southern Zhejiang, China

**Tie-Zheng Zhao**

**Yang Zhao**

During the process of rural rehabilitation in contemporary China, the multiple objective planning such as land use and environmental protection should be integrated into one united system. Ecological ideas should play a leading role in the rural landscape planning and design. This study tried to apply a strategic concept of Multiple Objective Ecological Optimization (Eco-optim+) through the process of rural industry development, ecological livable environment construction, ecological conservation and usage, and landscape heritage protection and restoration. Eight villages were used as field cases to examine this concept in Southern Zhejiang, China. A method of ecological landscape performance evaluation was used to study the cases' social and cultural factors. The indicators of Eco-optim+ concept in rural landscape planning could be summarized as follows:

The ecological optimization in the transformation of rural industry from farming to the tertiary industry sector;

The ecological inhabitation improvement as a key factor in rural landscape planning;

The ecological environment conservation under strict ecological red-line control;

The livable landscape in the integration of rural landscape heritage protection and restoration with ecological inhabitation and ecological industry under sustainable development guidelines.

For detailed landscape design indicators, the “progressive improvement” as an important guideline was demonstrated by two case studies of village landscape design. As a problem-oriented study, this paper also illuminated the imminent issues in the rural landscape scenarios, including:

The endangered rural ecological environment in mountain areas, as a result of the excessive sprawl of nursery stock industry to destroy ground nature for the commercial need of urban greening;

The demolition, relocation and merge of traditional villages in the past 10 years; Instead of passive protection, initiative act will be encouraged in the rural ecological construction procession through the regional coordinated development with the introduction of ecological health caring and recreation industry on the basis of rural ecological protection and water conservation;

The cultural restoration and cultural ecology value should be highly emphasized with the support of law binding system to rein the commercial rush of “fake antique landscape construction”.

In conclusion, the Eco-optim+ concept in rural landscape planning and design will attract wide attention in modern China. It is necessary to promote rural landscape planning as a key interweaving thread in social, economic, and living landscape integration under the guidance of sustainable development.

# Urban Stormwater and Vacancy: New takes on Green Infrastructure

**Sean Burkholder** State College of New York at Buffalo

While common, the management of urban stormwater is still a herculean task that continues to be pregnant with possibilities for landscape architects and academics alike.

This presentation will focus on two related but different undertakings by the author on the topic of urban stormwater management. Both take place in the Great Lakes Region, where combined sewers and vacant land both exist in disproportionate numbers; and take as a base assumption that these are synergistic conditions that could provide opportunity for designers, researchers and local residents.

The first project is a collection of small, single-lot landscapes in the cities of Buffalo, New York; Cleveland, Ohio; and Gary, Indiana. The hypothesis of the project is that by de-centralizing stormwater management, we can reduce the reliance on larger and less realistic green and grey infrastructure projects, while also stabilizing neighborhoods that have experienced significant population loss. The design and construction of these projects is just recently complete, with stormwater monitoring to begin in the spring. The decision to focus on the single, sporadic vacant property (as opposed to vast expanses of vacant land) was predicated on the idea that these are also prevalent in other places with lower vacancy, thus increasing the transferability of the project outcomes.

The second project is the creation of a tablet application for the city of Buffalo, New York to aid in the quick assessment of stormwater performance on vacant parcels. The premise of the project is that by understanding the existing stormwater performance of vacant land, we can find ways to adjust demolition and maintenance practices to begin enhancing that performance over time. Data collected includes soil conductivity, compaction, elevation variation and hydrophilic plant species. Assessments will be conducted to evaluate the 5000+ parcels demolished between 2000 and 2010. To date 280 parcels have been evaluated, and results of this preliminary data will be presented.

Presently, the findings of both of these projects are inconclusive, as very little monitoring and assessment have been completed. However, underlying both of these projects is the assumption that site selection and evaluation methodologies matter within the complex physical systems of the urban environment. This presentation will prioritize the successes and challenges of these on-going projects in a way that presents the projects themselves as meaningful beyond the data collection that motivated them.

# Proposed Monitoring Plan for the Anticipated College of Architecture, Planning & Design Research Green Roof Systems

**Lee Skabelund** Kansas State University  
[lskab@ksu.edu](mailto:lskab@ksu.edu)

**Carol Blocksom** Kansas State University  
[blocksom@ksu.edu](mailto:blocksom@ksu.edu)

**Mary Knapp** Kansas State University  
[mknapp@ksu.edu](mailto:mknapp@ksu.edu)

During the past ten years green roof monitoring has increased dramatically, with landscape architecture faculty/students offering important contributions (e.g. Coffman & Waite 2010; Sutton et al. 2012; MacIvor et al. 2013). Researchers and designers recognize the need for monitoring that informs practice, especially for mixed-vegetative systems composed of sedums, native grasses, and/or forbs (Simmons et al. 2008; Nagase & Dunnett 2010; Carlisle & Piana 2013; Dvorak 2015; Whittinghill et al. 2015). Longer-term, multi-season monitoring, particularly of the hydrologic and microclimatic conditions related to substrate and plant community performance, is vital to improving the design, implementation, and management of green roof systems (Skabelund et al. 2015). Creating resilient, low-resource green roofs that fit project objectives, specific setting, and larger eco-regional context requires understanding establishment, growth, and survival of mixed-vegetative communities on green roof systems.

This presentation discusses the development of a design for replicated green roof research plots to be installed on the roof of a new College of Architecture, Planning & Design (APD) building on the Kansas State University (Manhattan, Kansas) campus. The proposed design is informed by the team's current green roof research project (Skabelund et al. 2014), peer-reviewed literature, and lessons learned from projects by designers and scientists across North America.

A plan for installing a research green roof was collaboratively developed by an interdisciplinary team at Kansas State University which included landscape architecture, climatology, and plant sciences disciplines. The proposed plan was shared with the professional design team during the new APD building design stage, with continuing dialog during the construction documents completion phase. The roof will meet the stringent research requirements needed for advancing the knowledge of how extensive and semi-intensive green roofs function, and incorporate plots with three different substrate depths, two different substrate types, and 72 planted plots composed of three different multiple-species mixes. Hydrological and micro-meteorological conditions (precipitation, irrigation, air and soil temperatures, soil moisture, and evapotranspiration), and substrate characteristics will be monitored through instrumentation placed during the green roof installation; correlations between these conditions and plant growth will be sought.

After installation, faculty and students will assess vegetation growth and micro-climate dynamics via targeted monitoring and data analysis. Upon completion of their research experience, students should have skills that improve their ability to plan, design, and manage resilient, cost-effective green roof systems.

# Replicable Surveys and Generalizable Outcomes: Looking Beyond Case Studies in Social Performance Research

**Mary Myers** Temple University

**Taner Ozdil** University of Texas at Arlington

**Elen Deming** University of Illinois Urbana Champaign

**Heather Whitlow** Landscape Architecture Foundation

In landscape architecture, the written and visual documentation of projects as case studies serves as the main body of information and the collective record of the advancement and development of new knowledge. Together, case studies provide the primary form of education, innovation, and testing for the profession. (Francis, 2001, Groat and Wang, 2002).

The Landscape Architecture Foundation's *Case Study Investigation (CSI)* program and other post-occupancy evaluation initiatives are steadily producing a body of case studies focused on the measureable environmental, social, and economic impacts of landscape architecture projects. This body of work presents an opportunity to assess commonalities across the cases to better understand how site design and other variables impact performance. Comparing results from different sites provides insights about what works and what doesn't work, helping to build the body of knowledge in the landscape architecture discipline. However, inconsistencies in the methods for quantification, tools, and how they are applied make cross-case study analysis problematic.

The social performance of landscape projects is frequently measured through user surveys (Burgess et.al, 2014). In addition to demographic information, these surveys can gauge frequency and type of use, geographic impacts, understanding of natural processes, and perceptions and attitudes related to quality of life, sense of identity, safety and security, and health and educational benefits. Typically, surveys are developed for a particular performance claim or line of inquiry at a particular site. However, a standard set of survey questions that can be used across different scales and types of projects would allow for better comparisons across projects and could simplify the process of survey development and Institutional Review Board (IRB) approval.

This panel session will review some of the research design strategies that CSI Research Fellows have used for social performance indicators over the years, and present a generalized questionnaire for satisfaction with open space projects. The questionnaire includes questions about how frequently respondents visit the space, how they feel after spending time there, and whether it influences their quality of life. Panelists will discuss the pros and cons of using a generalized survey method and present examples of how such an instrument could be customized using actual case examples from the *Landscape Performance Series*.

The session will end with an open audience discussion on the generalized questionnaire, how it could be strengthened, and the opportunities that having a consistent set of questions presents for systematic reviews and synthesis of research across projects.



# Landscape Performance Case Study Meta-analysis: a step toward informing design

**Mary Myers** Temple University

**Bo Yang** Utah State University

Landscape performance was initiated by the Landscape Architecture Foundation (LAF) in 2010, to demonstrate the value of landscape architecture to society and the environment. Its purpose is to “to build capacity to achieve sustainability and transform the way landscape is considered in the design and development process.” As of June 2015, the Landscape Performance Series’ (LPS) library contains 100 case studies allowing researchers to extract useful information to inform design. But it can be difficult to look across the spectrum of studies to determine which tools are most useful for a particular project, or to assess relationships between design elements and performance optimization. Moreover, each case study has unique aspects, making it difficult for the discipline to form generalizable theory from a relatively small number of cases.

This presentation describes preliminary results of the analysis of the 100 published LPS case studies,. Benefits are assessed across the LAF case portfolio (per benefit category and project type), and methods and data options available to perform the analyses. The existing case studies are downloaded from the LPS website. Project information (e.g., project name, location). Details of the methods, metrics, and performance benefits are entered into Microsoft Office Access. The cross-table function enables selecting multiple variables and examining their correlations simultaneously. A series of these analyses will help to identify patterns of project’s success in terms of performance measurement.

Results describe: (1) Tools and methods that have the highest frequency of use; (2) Typologies of case studies (size, type, location) related to benefit categories (stormwater, habitat, carbon/energy, social); and (3) The most frequently measured benefits and corresponding project types.

Current LPS benefit categories and tools correspond with Millennium Ecosystem Assessment definitions of ecosystem services, such as, flood regulation, biodiversity, carbon sequestration and social benefits. The current population boom and shift toward living in cities suggests that design will play an increasing role in providing ecosystem services within urban environments. Landscape architects need to understand and quantify their designs to better understand how to maximize ecosystem services. Finally, based on the meta-analysis results, this study provides suggestions on improving landscape performance research, in the enterprise of achieving evidence-based designs that are anchored in quantitative performance measures .

# The use and abuse of ecological concepts in landscape architecture

**Stephanie Carlisle** University of Pennsylvania  
[steph.carlisle@gmail.com](mailto:steph.carlisle@gmail.com)

**Nicholas Pevzner** University of Pennsylvania  
[pevzner@design.upenn.edu](mailto:pevzner@design.upenn.edu)

In the last decade, the growing discipline of urban ecology has made significant gains in understanding and modeling ecological function in cities. Designers, meanwhile, have brought fresh imagination, spatial nuance and graphic intelligence to how urban landscapes are visualized, built and maintained. Communication between designers and environmental scientists, however, is often hindered by a lack of shared vocabulary and analytical methods. Although the concepts of flexibility, open-endedness, and indeterminacy are aligned with contemporary ecological theory, these concepts don't in and of themselves constitute a set of strategies rich enough to provide meaningful ecological guidance for designers.

Landscape architecture's heavy use of metaphor and illustration in describing ecological processes underplays complex ecological mechanisms in favor of idealized outcomes and images (Pickett et al. 2013). Natural forms don't inherently result in ecological function, (Nassauer 1995) highlighting the importance of critically integrating ecological mechanisms with design strategies.

To move beyond aesthetically nuanced but ecologically ungrounded imagery, landscape architects should be trained to analyze the ecological functions of their designs, and be able to apply ecological principles to the complex and layered urban sites on which most contemporary design work takes place. Similarly, ecologists need to develop more nuanced vocabulary for describing built and designed landscapes, and be more proactive in speculating on the ecological function of designed scenarios even in the face of a dearth of data.

Design education has the opportunity to help bridge this disciplinary divide by preparing design students to more effectively communicate and collaborate with ecologists. A course led by the authors has been seeking to develop shared vocabulary between ecology and design, and to build relationships across disciplines. By teaching design students to engage with contemporary ecological literature, exposing students to robust experimental design and ecological field assessment methods, and introducing them to practicing restoration ecologists, the course prepares students to employ fundamental ecological mechanisms to more credibly and effectively model landscape performance over time. Rigorous diagramming exercises, capturing the relationships between ecosystem elements and the ecological mechanisms, empower students to interrogate the inputs, feedbacks, stresses, and disturbances that shape landscapes over time. Restoration and management plans developed as part of the course utilize contemporary understandings of vegetation dynamics, landscape connectivity, biogeochemical nutrient cycling, urban soils and hydrology. An understanding of these ecological mechanisms enables students to critically evaluate their design proposals with an eye towards ecological function.

# US Coast Guard Headquarters Heat Island Performance

**Christopher D. Ellis** University of Maryland

[cdellis@umd.edu](mailto:cdellis@umd.edu)

**Dylan Reilly** University of Maryland

[dreilly@umd.edu](mailto:dreilly@umd.edu)

Heat island effect can increase energy consumption, compromise human health and comfort, elevate emissions of air pollutants and greenhouse gases, and impair water quality (US EPA). The annual mean air temperature of dense urban areas can be 1.8 to 5.4 degrees (F) higher than their surroundings (US EPA). Designers can make a difference by specifying surface materials and landscape treatments that contribute less to the absorption and emission of solar energy (Gartland, 2008).

The new US Coast Guard headquarters building in Washington, DC was designed in part to minimize its contribution to heat island effect. Extensive use of green roofs, minimal impervious land cover, and a preference for herbaceous and woody plants rather than cut lawns were expected to perform better than traditional roofs and parking lots that are characteristic of large office complexes.

To test this assumption, the surface temperatures at the headquarters for the sedum (extensive) and tall plant (intensive) green roofs, herbaceous and woody planted areas, concrete, asphalt, and stone were all recorded with one reading per hour over a 2 month period from June to July 2015. The performance differences between these surfaces are significant and complex and will be discussed in the presentation. The various surface temperature values were also used to estimate the comparable surface temperatures at the traditional office complex. The acres of each land cover type at the headquarters and at a nearby traditional office complex were measured and used to weight an overall surface temperature contribution separately for each site. The weighted average surface temperature for the USCG HQ was 86.7 (F) while the traditional office complex was 88.3 with an average difference of 1.6 degrees (F). This value is nearly within the range of the annual mean temperature differences between dense urban areas and their surroundings as reported by the US EPA.

The methods used in this study are unique in that they offer a way for designers to model contributions to heat island effect based on the type and amount of land cover. Other studies measure surface temperatures or ambient air temperatures but do not weight these values by the total area of surface type (Heusinkveld et al., 2014; Klyzik & Fotuniak, 1999). As this technique is tested and further refined, it will offer a helpful way for landscape architects to estimate the heat island performance of their design alternatives.

# Biodiversity at the U.S. Coast Guard Headquarters: Analyzing Quantitative Measures of Performance

**Dylan Reilly** University of Maryland  
[dreilly@umd.edu](mailto:dreilly@umd.edu)

**Christopher D. Ellis** University of Maryland  
[cdellis@umd.edu](mailto:cdellis@umd.edu)

The new U.S. Coast Guard headquarters landscape in Washington, D.C. is an excellent example of how site biodiversity performance can be improved dramatically through design. Measuring the biodiversity of a design is becoming increasingly more important as sustainable site design grows in demand and design performance is expected to be evaluated with sufficient rigor.

At the Coast Guard headquarters, native vegetation and hardscape in each courtyard calls out the character of five D.C. area eco-regions: Blue Ridge, Piedmont, Northern Piedmont, Southeastern Plains, and Middle Atlantic Coastal Plain. The planting design emphasis was on the use of native plants in a habitat style of aesthetic rather than a more formally structure arrangement. The vast majority of office workers were found to be satisfied with the courtyards and thought the workplace positively impacts the local ecosystem.

The woody plant biodiversity of the Coast Guard headquarters was compared to a comparable size office complex in the D.C. region designed in a more traditional way with high-rise buildings surrounded by parking lots. Herbaceous plants were excluded from the analysis due to the difficulty in counting all herbaceous plants on the 24 acre traditional office site. A systematic zone-based approach was used to count all woody plants by species at the traditional site while the final planting plan was used to count woody plants at the Coast Guard headquarters. Richness, abundance, and the Shannon diversity index of native woody plants were compared between both sites.

The U.S. Coast Guard Headquarters design was found to include 7 times more native woody plant species and 8 times more native trees than the more traditionally designed office landscape. The Shannon Biodiversity Index (SBI) value for native woody plants on the Headquarters was 1.82 which was clearly higher than the traditional office complex that was measured at an SBI of 1.47.

A number of key design strategies led to the higher performance measured at the Coast Guard site including minimal use of lawn space, extensive use of green roofs and living roofs, minimizing the parking foot print through multi-story garages, support for alternative transportation, and the adoption of a habitat style of aesthetic. The research also explored how quantitative measures of biodiversity can support the creation of planting plans that better mimic desired ecosystem outcomes and suggests this area as important for future study.

# The Benefits of Unmanned Aerial Vehicles (UAVs) for Analyzing Land-Cover Temperature

**Sung Ho Kil** Texas A&M University  
[todd219@tamu.edu](mailto:todd219@tamu.edu)

**Jun-Hyun Kim** Texas A&M University

**Galen Newman** Texas A&M University

**Dong-Kun Lee** Seoul National University

**Jong-Hoon Park** Seoul National University

The unmanned aerial vehicles (UAVs: well-known as drones) has emerged as a new remote sensing method to assist both spatial ecology and environmental sciences. The use of UAVs has been limited with issues related to infringement of privacy, trespass of air route, and protection of military service. However, UAVs possess the advantage of being a lightweight, cost-effective, versatility of sensor choice (e.g. thermal camera, FLIR, GoPro, etc.) and easy operation to examine the study site.

A wide range of techniques has been used to examine temporal and spatial scale in ecosystems, and remote sensing has been extensively utilized in various disciplines. The techniques of remote sensing have primarily focused on regional and global scaled observations to obtain time-series samples of ecological analyses. There is a wide range of resolutions ranging from 0.3m to 1km in the remote sensing data based on the size of satellite pixel captured by the number of different sensors.

Although researchers can select any optimal resolution following their research purposes, data obtained from satellites does not typically satisfy with measuring local objectives due to three main limitations: (1) cloud constraint; (2) difficulty of repeat survey on a designated site; (3) high cost in case of high resolution images.

Technological advancements in the capabilities of UAVs have allowed multiple fields such as land-cover temperature studies to take a more technical approach to research. Previous studies related to land-cover temperature have drawn on various equations using the combined bands of satellite as an indirect method. Thermal cameras have been shown to produce validated and creditable performances in comparison with an approach of band combination.

The preliminary findings of this research will introduce a pilot test measuring land-cover temperature. The study of UAVs depends on flight route, time and height of UAVs from the ground on the basis of pixel resolution. The concurrent shot can be helpful to meet experimental condition to conduct a controlled test relying on UAV condition regardless of cloud interruption. In addition, repeat measurement using UAV can be available on a designated time and a specific position. Lastly, because UAV would have gradually an economic price to operate it, utilizing UAV can approach easily to interpret urban and rural temperature. These benefits of UAVs can understand a sophisticated temperature according to the type of land-cover in a regional area.

# Landscape Architecture, STEM Education, and Landscape Performance.

**Byoung-Suk Kweon** University of Maryland

**Christopher D. Ellis** University of Maryland

**Mark Storie**

Recent efforts to classify landscape architecture as a science, technology, engineering and math (STEM) discipline cite the Landscape Architecture Foundation's Landscape Performance Series (LPS) as examples of the STEM foundation of the discipline (Cairns & Rotar, 2015). In fact, some LPS case studies show how K-12 school landscapes can be designed to support STEM education through the development of outdoor learning spaces. Constructed wetlands can provide a foundation for studying hydrology, wetland ecology, and water quality treatment. Vegetable gardens can be used to teach plant biology, soil chemistry, and nutrition. Rain gardens to be used to teach habitat, plant communities, and the importance of pollinators.

Three schools were studied for multiple dimensions of landscape performance including the extent to which learning opportunities were documented as benefiting all levels of education, including STEM. These included the Sidwell Friends School and Brent Elementary School in Washington, DC and the Willow School in New Jersey. Each school demonstrated how schoolyards can be designed to meet the needs of teaching objectives while addressing the environmental and technical needs of the school sites. For example, the Sidwell Friends School constructed wetlands in their middle school courtyard to treat both stormwater and wastewater immediately outside the classroom windows. The children are taught how the systems function, have class assignments that physically engage the wetlands, and even lead over 75% of the public tours of the site (over 10,000 visitors from 2006 to 2012). At the Willow School, about 250 students throughout the school year participate in school gardening by planting, watering and harvesting fruits and vegetables. An estimated 1% of the school's food is grown in the school gardens and adjacent fruit trees. An average of 280 pounds of compost is collected by the school's recycling program per month which is added to the student maintained vegetable garden.

These opportunities are made available by designing them into the schoolyard landscapes. The interventions enable STEM education by intentionally making the scientific processes and technical solutions accessible to students and teachers. The full set of measurable benefits for each school will be described in this paper including the ways in which students and teachers use the schoolyards for educational purposes.

# Reading the Cultural Specificities of the Iraqi Marsh Arabs from their Landscape

**Rasha Al-Tameemi** University of Cincinnati  
[altamers@mail.uc.edu](mailto:altamers@mail.uc.edu)

Iraqi Marshlands are irregular clusters of small islands constructed by alternating layers of reed and mud that dredged from the marsh bottom to constitute one of the most fascinating regions of the world. Marshlands in Iraq are intriguing environments for scholars because of their long history that dating back to the Sumerian civilization. Until 1992, Iraqi marshes remained relatively unknown to the general public but widely known to archeologists and scholars of Mesopotamia. The Marshlands are one of the most ancient centers of dwelling in Iraq's history, and scholars like Sam Kubba and Abbas Jamali suggest they are the cradle of Sumerian civilization.

However ancient history is not what brought the region to public discourses involving the environment in recent years. Iraqi marshlands have captured the attention of the international community from their depletion by the dictator Saddam Hussein in 1992 as retribution to the inhabitants who opposed and rebelled against his government. The draining of the swamps led to severe environmental, social, and economic consequences for local residents and landscape.

# Landscape Performance in a Rural State: A Bold Idea in a Change Averse Town

**Matthew James** South Dakota State University  
[matthew.james@sdstate.edu](mailto:matthew.james@sdstate.edu)

**Erika Roeber** South Dakota State University  
[erika.roeber@jacks.sdstate.edu](mailto:erika.roeber@jacks.sdstate.edu)

In order for a popular public space to be deemed successful, the claim should be substantiated with evidence-based research. Deming and Swaffield (2011) noted that through the dynamic intersections in research, landscape architecture will expand through formalized ways of collecting and validating knowledge. Ozdil, Richards, and Earl (2015) asserted that value assessment of completed projects has been promoted for decades and landscape architecture has begun to meet these evaluative needs, notably through systematic efforts like the Landscape Performance Series, sponsored by the Landscape Architecture Foundation (LAF).

In this particular LAF Case Study Investigation (CSI), James and Roeber (2015) partnered with firm 4Front Design to study factors driving the success of Main Street Square, a one-acre downtown space in Rapid City, South Dakota. In 2008 the city examined the current health and potential of their downtown. The findings suggested that the downtown needed a defining icon in the form of a gathering plaza. In 2010, a Business Development District was created to fund the operations of The Square until it became self-sustaining (Main Street Square).

This presentation reviews the environmental, social, and economic data collected through measurable methods. Key findings include data indicating that the space attracts over 600,000 annual visitors, roughly 70% of the state's population, through diversified events. Additionally, The Square created 15 full-time and 50 part-time jobs, and reduced ground level air temperatures by 2.5 degrees Fahrenheit as compared to the previous parking lot. Varied limitations for this particular site included: arriving at visitation numbers through averages of previously noted attendance as opposed to raw data collection, only summer seasonal temperature readings were used in data collection, and survey collection participation numbers were less than our anticipated goals made difficult through project time restraint.

This presentation provides value assessment with measured means for an unlikely project in a skeptical town. The importance of this presentation is adding objectivity and tangible metrics to landscape architecture, which can only strengthen the future of the field. The field of landscape architecture in South Dakota struggles with a public identity that is undervalued. The dilemma in a rural state, with very few urban plaza projects, is to sell the community on the benefits of a perceived, radical idea. If we can measure those benefits and present the data in such a way as to celebrate the field, it can add to a dynamic interpretation of the discipline moving forward.



# Understanding Courtyards at US Coast Headquarters: A Methodology to Quantify Use and Density

**Dylan Reilly** University of Maryland  
[dreilly@umd.edu](mailto:dreilly@umd.edu)

**Christopher D. Ellis** University of Maryland  
[cdellis@umd.edu](mailto:cdellis@umd.edu)

Measuring and understanding the use of public spaces is important as clients and designers look to justify expenditures and ensure successful designs. Expanding the range of methods used to quantify the use of public spaces is also important because each has benefits and limitations. Video and time-lapse photography are used to study how people use public spaces (Whyte, 1980) using creative ways to quantify and interpret results. Time-lapse photography, used in combination with a survey questionnaire quantified performance of a courtyard in a large office building. The purpose of the study was to explore the relationship between courtyard design and use.

In the spring of 2015, the main courtyard of the new Coast Guard headquarters in Washington DC, was studied using 6 hours of time-lapse photography set at 1 minute intervals. The day was chosen to be representative of good weather for outdoor activity. Future study could photograph a courtyard in different weather conditions and seasons to obtain a clearer picture of how courtyard use evolves throughout the year. A Canon EOS Rebel Xsi was set up in a high room with good vantage over two courtyards. Photographs were taken at  $2256 \times 1504$  pixels (low) resolution to protect individual identity. The total number of people standing and sitting in each frame was counted.

Three hundred thirty six (336) distinct individuals were found to use the courtyard throughout the day. Line graphs show people using the tables and benches mostly in the early afternoon, lunchtime, and then mainly walking through the space in the morning and afternoon. To better understand the spatial use of the courtyard, use observed in each frame was digitized into GIS. A Kernel Density Analysis was run to visualize courtyard use in the morning, at lunchtime, in the afternoon and overall. Finally, an IRB approved survey questionnaire was conducted. One hundred and one questionnaires were distributed to workers entering a dining hall at lunchtime with ninety-six questionnaires returned (95% return rate).

The courtyard, with designed elements like movable chairs, static benches and awnings, was found to provide places for people to gather, conduct meetings, socialize, and eat. The courtyards also functioned as outdoor hallways, connecting office building together. The majority of office workers were satisfied with the courtyards (77%). Satisfaction with outdoor space was significantly correlated with respondent's opinion that there was ample ( $r: 0.48, p < 0.000$ ), walkable ( $r: 0.48, p < 0.000$ ), outdoor space that was good for social interaction ( $r: 0.43, p < 0.000$ ).

The objective and subjective measurements paint a clear picture of a successfully designed and used courtyard. Methods are simple to use but require dedicated time and patience to process data. They build upon time-honored practices of structured visualization methods used to evaluate the performance of public open spaces.

# LANDSCAPE PLANNING AND ECOLOGY



# Journeys in the Cultural Landscapes of Okhamandal in Gujarat, India: An Ecological Model for Heritage Conservation

**Heena Gajjar** University of Illinois at Urbana Champaign

**Amita Sinha** University of Illinois at Urbana Champaign

In the study of the cultural landscape of Okhamandal in Gujarat, India, conservation practices of cultural heritage are leveraged in planning for ecological restoration. Okhamandal, one of the four holy sites across the Indian subcontinent, is facing drastic pressures of climate change resulting in rising sea levels, salt ingress, desertification, scarcity of water for drinking and farming, and a severe threat to the heritage sites. Okhamandal has many sacred sites, the largest of which is the holy city of Dwarka, where the Hindu god Krishna established his kingdom in antiquity. Krishna is an incarnation of Vishnu, the sustainer in the Hindu trinity of gods who create, uphold and destroy the universe unceasingly. In the cyclical understanding of time in Indic thought, creation is always preceded by destruction. Dwarka, along the coast was swallowed by sea upon Krishna's death, a legend corroborated by underwater archaeological findings dating back to 15th BCE (Rao, 1999; Gaur, 2004). Changes in the shoreline suggest that rising sea levels have inundated and destroyed coastal settlements, as many as seven times. Okhamandal, a peninsula connected with the mainland by a narrow isthmus between the sea and the desert, is once again under threat. The highest elevation in this region does not exceed 150 feet above sea level. The trend for mean sea level rise is 2.06 mm/ year ( $\pm 0.06$  mm) for the Okhamandal region, thus the projection for next 100 years is a 0.68 foot rise in sea level. If this occurs, it is likely that the culturally significant sites within the Capital of Krishna will be submerged for the eighth time. Conservation of its sacred and archaeological sites is proposed based on the model derived from the scientific systems approach and faith based environmental ethic. The environmental ethic is developed from the concept of 'Krishna consciousness' representing a reverential and caring attitude towards nature demonstrated by working in harmony with natural systems. Reclamation strategies such as ground water replenishment by reviving wetlands and sacred water bodies; and mitigation of coastal erosion through green terracing and floating islands are proposed to promote resiliency. These strategies guide the design of an eco-cultural heritage trail for pilgrims circumambulating the sacred sites of Okhamandal. The trail will link sacred, archaeological and ecological sites, introducing the pilgrims/visitors to 'Krishna consciousness' while experiencing the cultural landscape. Its restored sites will also set a precedent for environmental reclamation of Okhamandal peninsula.

# The Miasmist: George E. Waring, Jr. and the Evolution of Modern Public Health

**Catherine Seavitt Nordenson** City College of New York  
[cseavitt@seavitt.com](mailto:cseavitt@seavitt.com)

George E. Waring, Jr. developed an influential manual in 1867 entitled *Draining for Profit, Draining for Health*, reflecting two particular obsessions of the gilded age—wealth and miasma. The long-held miasma, or anti-contagionist, theory held that the origin of disease was in the air, emerging as a poisonous vapor from rotting organic matter in damp soil. By the 1880s, the new contagionist theory of the germ was gaining European support, yet Waring remained a lifelong miasmist, supporting the anti-contagionist movement in the United States. Believing the cause of disease to be the result of excess moisture in the ground—the “ground water theory” developed by German scientist Max von Pettenkofer—Waring prepared a comprehensive drainage plan for Central Park in 1856. His title, Superintendent of Drainage, seems unusual, but the very idea of Central Park was to provide much more than a place of recreation and open space within the city—its acreage was a carefully constructed argument to combat disease in an increasingly crowded city. The park was conceptualized not as a captured territory of unspoiled “nature,” but as a massive air, water, and ground cleansing machine that would restore health to the urban populace. Waring drew on his knowledge of farm drainage and applied it to this urban park on a massive scale, mechanically transforming locations of damp ground from their existing hydrology into a gravity-fed hydraulic system that would quickly shed surface and ground waters.

The miasmists, their theories disproved by the success of germ theory in the early twentieth century, failed brilliantly in the urban realm, leaving an extraordinary contemporary legacy. Their focus on the physical environment developed into contemporary urban public health strategies supporting a healthier populace. Waring’s mechanized park serves as both an atmospheric scrubber and carbon sink. His reforms at the Department of Street Cleaning in New York City, separating waste by category, led to modern practices of recycling and waste reduction. His separated sewer system at Memphis is the radical solution to antiquated combined systems that discharge stormwater and raw sewage into adjacent waterways, and his sewage work in Havana, Cuba helped reduce yellow fever. Reinterpreted today, the miasmists’ emphasis on clean water, air, and soil reflects much more than a singular concern with disease transmission. Their environmental focus, based on scientific error, nonetheless supports the contemporary vision of reducing the environmental impact of urban actions on the atmosphere, waterways, and planet.

# Evaluating CWWP effectiveness: Wildland fire and defensible space

**Travis Flohr** University of Wisconsin-Madison  
[tflohr@wisc.edu](mailto:tflohr@wisc.edu)

The American affinity for areas rich in natural amenities, such as forests, lakes, mountains, seashores, and areas adjacent to protected lands (e.g. parks or wilderness areas), continue to push development into the wildland urban interface (WUI) (Radeloff et al., 2005). The expansion of homes and associated commercial development in the WUI places property, assets, and human lives at risk from wildfires. Approximately, 65% of the WUI is in a high-severity or emerging high-severity wildfire risk zones (Radeloff et al., 2005). Currently, federal policy encourages at-risk communities to develop Community Wildfire Protection Plans (CWPPs). While only 9.4% of the land area of the United States is in the WUI, it contains 38.5% of the United States' housing units (Radeloff et al., 2005). Additionally, the WUI has grown by 52% since 1970 and is expected to grow an additional 10% by 2030 (Theobald & Romme, 2007). The areas that will receive the largest amount of growth include the Intermountain Western states of Arizona, Colorado, Idaho, Montana, Utah, and Nevada and the Upper Midwestern states of Indiana, Minnesota and Wisconsin (Theobald & Romme, 2007).

Research has shown that the resiliency and sustainability of the WUI depends on an integrated, multi-scalar response to wildfire; one that synthesizes fire science with WUI development policy and homeowner's values (Field & Jensen, 2005; Radeloff et al., 2005; Theobald & Romme, 2007). However, little research has evaluated the effectiveness of CWPPs on implementing wildfire mitigation strategies. In this study, I will present preliminary results of an extensive PhD project with three main areas of research. First, in this project, I will evaluate the effectiveness of CWPPs in reducing fuel load and increasing defensible space. Second, I will methodologically broaden the scope of wildfire research through a stratified, large *n* municipal government scale sample and spatial analysis of CWPP mitigation objectives. Third, I will empirically evaluate the socio-economic, demographic, and biophysical conditions, which lead to effective CWPP implementation. My methods include 1) remote sensing land cover change techniques and 2) spatial statistics. Preliminary results suggest that CWPP policy has been largely ineffective in creating large-scale landscape change in defensible space; however, there are promising clusters of change that require further exploration. The outcomes of this study will help designers and planners describe effective CWPP implementation and understand the conditions that facilitate effective implementation.

# **'Incomplete' Green Infrastructure: Lessons Learned from Rapid Urbanization in Beijing, China**

**Huaqing Wang** Texas A&M University  
wanghuaqing@tamu.edu

**MingHan Li** Texas A&M University  
mli@arch.tamu.edu

China's rapid urbanization in recent decades has resulted in various negative effects, such as urban floods. For the example of Beijing, serious urban floods have hit the city annually since 2004. Each time when a flood occurred, the city's infrastructure was traumatized, including 41 major corridors and highway intersections inundated in 2004; Beijing International Airport paralyzed in 2006; 79 fatalities on July 21th, 2012. However, urban floods seemed not affecting the urban parks in Beijing. Urban parks are valuable green infrastructure with a potential for mitigating floods. Unfortunately, the rapid urbanization process in Beijing overlooked hydrologic benefits parks can provide. Several parks in Beijing are considered 'incomplete' green infrastructure because they are not designed to be hydrologically connected with the surrounding areas and therefore, do not mitigate floods for the areas.

We took Taoranting Park, an urban park in Beijing, as an example, and analyzed the catchment area and green land ratio. We identified the factors that contributed to the form of 'incomplete' green infrastructure. Our study tasks included reviewing the park's construction history, interviewing the chief of the park, interviewing witnesses of urban floods, analyzing the topography and calculating the catchment area of the park based on ArcGIS 10.

We found mismatch exists between grey and green infrastructure. The calculated catchment area of the Taoranting Park had the capacity to store the stormwater runoff volume produced by not only the park itself but also its surrounding area. However, underground pipelines and road drainage system around the park directed stormwater runoff to the municipal storm sewer system at the perimeter instead of towards the park. These findings indicate three oversights. The first is the lack of consideration in fully using the ecosystem service of green infrastructure when designing parks. The second is the lack of communication between the departments that are in charge of grey infrastructure and the one that is responsible for green infrastructure. The third is the lack of authority of green infrastructure management departments in retrofitting green infrastructure to reduce the pressure on grey infrastructure.

Lessons learned are summarized. For these parks, inadequate planning and execution occurred from a hydrology perspective. We suggest effective communications must be established between grey and green infrastructure departments and proper authority should be given to infrastructure management departments. New planning practice should integrate both grey and green infrastructure. Retrofit should be done to establish the link between green and grey infrastructure.

# Air temperature Differences between Green Spaces and Non-Green Spaces in Highly Developed Urban Areas during Summer

**Jong-Hoon Park** Seoul National University

**Dong-Kun Lee** Seoul National University

**Jun-Hyun Kim** Texas A&M University

Research to reduce urban temperatures and mitigate the Urban Heat Island (UHI) effect has focused primarily on the role of large urban green spaces as cool islands. However, the role of small green spaces (SGs) such as street trees and pocket parks has not been fully investigated.

The purpose of this research is to assess the mitigating effect of SGs on micro-UHI through a comparative analysis of air temperatures of SGs and non-green spaces (NGs), that include building-shaded spaces (BS) and non-shaded, impervious, paved spaces (PS) completely exposed to sunlight.

Experiment was conducted across six urban blocks in a highly developed area in Seoul, South Korea during daytime in summer. Two researchers at each block simultaneously recorded air temperatures at 1.5 m above the ground level using mobile loggers at one-minute intervals for an hour.

Measurements were repeated three times and 1,296 temperature readings were collected in total. ArcGIS was used to perform solar radiation analysis to highlight SGs, BS, and PS on a thermal map. The highest air temperatures ( $T_{HP}$ ) and the lowest air temperatures ( $T_{LP}$ ) of each block were extracted and classified. Kruskal-Wallis Test utilizing SPSS statistics was used to determine the existence of significant differences in mean air temperatures between a group of SGs ( $T_{SGP}$ ) and NGs ( $T_{NGP}$ ).

The results showed that mean air temperatures ( $T_{Bi}$ ) in the six urban blocks ranged from 29.9°C to 33.9°C. SGs contributed to significantly reducing  $T_{Bi}$  up to 2.9°C while BS reduced  $T_{Bi}$  up to 2.7°C. The air temperature difference between SGs and NGs over all the blocks ranged from 0.2°C to 4.1°C. The air temperature difference between PS and SG was significant and ranged from 0.4°C to 4.1°C, while the difference between BS and SG was significant and ranged from 0.2°C to 1.0°C.

Evidently, the results support the hypotheses that SGs can play a significant role in mitigating micro-UHI in high-density urban areas. The results of this research could contribute to future UHI mitigation policies and/or design guidelines for planning small green spaces effectively in urban areas.

# The Adaptive Reuse of Urban Brownfields: Dilemmas of Urgency and Process

**Wolfram Hoefler** Rutgers, The State University of New Jersey  
[whoefer@sebs.rutgers.edu](mailto:whoefer@sebs.rutgers.edu)

**Zenon Tech-Czarny** Rutgers, The State University of New Jersey  
[ztech@rci.Rutgers.edu](mailto:ztech@rci.Rutgers.edu)

The big research questions concerning the adaptive reuse of abandoned contaminated industrial sites are largely answered; Environmental Engineers have developed remediation technologies; Planners understand regulations and redevelopment impacts on property values; and Landscape Architects are at the forefront of integrating post-industrial sites back into the urban fabric through creative design. But the questions remains: Why are so many urban brownfield sites still underutilized? This dilemma is an important twenty-first century topics for our profession because from a sustainability point of view, industrialized urban cores are in need of redevelopment and urban redevelopment protects remaining undeveloped ecosystems.

Famous projects such as the Gas Works Park in Seattle, the Landschaftspark Duisburg Nord in Germany, and the High Line in New York City, mark cornerstones of the well-established language of post-industrial landscape architecture. However, the process of transforming “typical” brownfield sites, such as those found in the rust belt and urban New Jersey is frustratingly slow. Obstacles to reusing these sites include economic challenges, as well as divergent interests of local residents and developers, both trying to influence often overstrained municipalities. In New Jersey, this situation is even more challenging because of segregated settlement patterns, fragmentation of municipal government, and extreme income disparities between municipalities. Influential corporate interests and a general distrust of government initiatives add to the problem. A brief historical review of industrialization and suburbanization of New Jersey will be used to identify recurring conflict patterns which help to explain current dilemmas.

Three NJ case studies will be presented, which will each discuss specific obstacles and how they are addressed. 1) A Historic Water work is an example for an intra municipal conflict on values, 2) a park on a landfill solar panels for are a controversial financing solution using solar panels, and 3) a storm protection levee on a former light industrial site for contradictory development visions and permitting issues. The Rutgers Center for Urban Environmental Sustainability (CUES) engagement method demonstrates how an iterative design process, which carefully analyzes conflict lines, enables CUES to successfully mediate local conflicts associated with adaptive reuse of urban post-industrial sites.

The paper will illustrate how community outreach as integral part of the design process can also be applied to situations when stakeholders have more influence than local residents. This paper argue for a greater leadership role of landscape architects in solving reuse conflicts.



# Evaluating Rural Landscape Design Decision Making Using Collaborative Geodesign Technology and Scaffolded Social Learning

**David G. Pitt** University of Minnesota  
[pittx001@umn.edu](mailto:pittx001@umn.edu)

**Bryan Runck, Madeline Goldkamp, Carissa Schively Slotterback, Jonathan Fillmore, Cindy Zerger, Len Kne, Nicholas Jordan, David Mulla, Michael Reichenbach, Alexander Heid**

The design of multifunctional working rural landscapes often involves the introduction of biomass for production of feedstocks for biofuel and animal nutrition as well as enhancement and optimization of ecosystem services production (1). Sustainable design scenarios must relate to world views of stakeholders, engage them in collaborative scenario construction, and allow them to evaluate the multifunctional outcomes of their design decisions. This paper reports on the use of scaffolded social learning and collaborative geodesign technology to engage southern Minnesota stakeholders in the design and evaluation of multifunctional landscapes that include biomass production. It identifies four strategies used by stakeholders as they pursued designs to optimize biomass and food commodity production in terms of the following six performance criteria: water yield, total phosphorus and sediment, habitat enhancement, carbon sequestration, and profitability.

Scaffolded social learning engaged stakeholders in interactive conversation about the relevance of biomass production in the design of multifunctional rural landscapes (2). It involved four workshops wherein stakeholders learned through presentations and small group discussions about the multifunctional issues associated with integrating biomass production into working rural landscapes. In subsequent sessions, stakeholders worked collaboratively with a geodesign tool using 55" touch screen displays (3) to assess landscape suitability for biomass production, construct design scenarios for its integration into the rural landscape, and evaluate multifunctional performance of the scenarios using the Soil Water Assessment Tool (SWAT) (4), and InVest (5). Stakeholder groups used performance feedback from the SWAT and InVest assessments to generate between six and nineteen designs in an iterative and collaborative process toward generation of optimized design scenario(s) for biomass production (6).

Qualitative evaluation of the scenarios produced over time by specific groups revealed both changes in spatial pattern of designs as well as multifunctional performance as stakeholders sought to optimize across the six performance criteria. The paper examines spider-plot graphs of multidimensional performance of each group's design scenarios to illustrate the use of four design strategies, including: *exploration* of individual biomass strategies; their *integration* into composite rural landscape patterns; scenario *refinement* based on performance feedback; and *regression* in which stakeholders appeared to create sub-optimal solutions. The paper also examines facilitative strategies that may help stakeholders realize more functionally optimal solutions.

# Forgotten Ecosystem Services: Conflicting Values between Storm Water Management and Ecological Integrity in Urban Playa Lakes

**Sohyun Park** Texas Tech University  
[sohyun.park@ttu.edu](mailto:sohyun.park@ttu.edu)

**Jared Horsford** Texas Tech University  
[jared.horsford@ttu.edu](mailto:jared.horsford@ttu.edu)

Playa lakes are a unique and ecologically significant feature in the Southern High Plains of Texas. These depressional wetlands have long served a vital role in the biodiversity of prairie ecosystems. In semi-arid prairie regions such as the Texas Panhandle, the playa lakes play a critical role in floodwater storage and groundwater infiltration. However, the increase in urban runoff volume and associated pollutant levels has degraded the playa habitats and exceeded the effective capacity of the system to mitigate floodwaters and filter pollutants through natural processes. In response, a number of natural playas have been excavated and engineered to increase volume and speed conveyance, further degrading a key component of the region's biodiversity.

In this study, we discuss missed potentials of urban playa lakes and discuss further how design and planning intervention can help bring the diminished ecosystem services back to adequate levels, particularly in disturbed playa ecosystems. As a case study, we examined the Clapp Park Playa Lake in Lubbock, Texas to explore how the conflicting values between storm water management and ecological health can be addressed through biomimetic design and site improvement planning, and what kind of forces can hinder these efforts. Initial efforts to propose a new design for this site were met with resistance from local storm water management authorities, so the discussion explores the role of design development and communication in alternative storm water approaches. It concludes with suggestions concerning open space governance and progressive planning to better manage urban playa lakes and immediate park spaces.

# Community development through participatory action research: A case study of Wyoming County, WV

**Peter Butler** West Virginia University

[pebutler@mail.wvu.edu](mailto:pebutler@mail.wvu.edu)

**Kudzayi Maumbe** West Virginia University

[kudzayi.maumbe@mail.wvu.edu](mailto:kudzayi.maumbe@mail.wvu.edu)

The goal of this project was to explore the viability of a variety of community development initiatives for Wyoming County, West Virginia focused on recreational and heritage tourism through participatory action research (PAR). PAR was deemed the most appropriate approach based on the need to involve the local residents and have them take ownership of the process and effect change (Arnstein, 1969). PAR aims to provide workable solutions to existing concerns as well as develop local capacity (Riel, 2010). The project scope included two phases: a quantitative survey collecting data on visitor experience and perceived resource gaps; and a participatory workshop and visualization phase. Through the leadership of the Wyoming County Economic Development Authority (WCEDA), the county is searching for alternative ways to diversify its economic base through tourism to reverse negative employment, domestic, education, drug abuse and economic trends. Data were collected through community-driven focus groups, stakeholder workshops and meetings, key informant interviews and structured surveys. Tourism became central to discussions in recognizing the county's rich coal heritage and natural resources. Tourism development has been successful as a rural development tool in distressed rural areas where traditional industries have declined (Sharpley & Sharpley, 1997). The engagement phase lasted for a period of eighteen months from June 2014 to December 2015 during which all research activities included active participation of community members. The results from this phase highlighted the county's critical areas of concern and strengths to focus on in the proceeding phases. Implementing the actions for change continued with a participatory mapping inventory which tied touristic development to local values, mapping sites of local significance and creating an 'off the beaten path' grassroots touristic itinerary. This project demonstrates trans-disciplinary and participatory action research methods as a model for generating positive change in an underserved and environmentally compromised area. Conclusions drawn from the multi-faceted approach demonstrate a strong correlation between identified visitor needs and local desires, revealing a strong potential for economic development in recreation and heritage tourism. Creating visualizations and planning documents that address both visitor and local desires then builds capacity towards implementation.

# Differences in nutrient and metal uptake among plant species in stormwater bioretention systems

**Malgorzata Rycewicz-Borecki** Utah State University  
[margie.borecki@aggiemail.usu.edu](mailto:margie.borecki@aggiemail.usu.edu)

**R. Ryan Dupont** Utah State University  
[ryan.dupont@usu.edu](mailto:ryan.dupont@usu.edu)

**Joan McLean** Utah State University  
[joan.mclean@usu.edu](mailto:joan.mclean@usu.edu)

Bioretention (BRs) cells are an integrated stormwater management practice often proposed and designed by landscape architects to reduce pollutants in stormwater and protect water quality. Landscape architects are charged with designing BR systems that provide social, recreational, aesthetic, hydraulic, and ecosystem services. Generally, certain plant species are known to take up more pollutants from water and soil than other species (Tanner 1996; do Nascimento and Xing 2006; Bratiers et al. 2008; Read et al. 2008), but little is known with regards to bioaccumulation potential differences among species typically found growing in these systems. Bioaccumulation is the process of absorbing and transporting compounds from the soil to the aerial parts of a plant, allowing for the harvest and removal of plants and sequestered contaminants (Meers et al. 2008). It decreases the potential for metals to enter groundwater supplies, and the harvested plant tissue can also be recycled via compost.

This 4-year field study (2011-2014), located in Northern Utah's Cache Valley, quantified biomass production and uptake of nutrients and metals (nitrogen, phosphorous, copper, zinc and lead) from local urban stormwater by three plant species typically found in stormwater BRs (*Typha latifolia*, *Carex microptera*, and *Helianthus maximilliani*) initially planted with plugs (*T. latifolia* and *C. microptera*) or seeded (*H. maximilliani*). 'Naturally seeded' treatment plots allowed plants to grow without intentional planting or weeding. Pollutant mass removal, as a function of twice-yearly or single end-of-season harvests, was also quantified among species over time.

The results of this study show that under field conditions the naturally seeded treatments produced significantly more biomass during the first 2 years of growth than the other treatments. However, all treatments reached steady-state biomass production during their 3<sup>rd</sup> year of growth, with no differences among treatments. Species differences were found, however, in nutrient and metal uptake over the 4-year period. For example, in 2014 *C. microptera* took up significantly more copper, zinc, nitrogen and phosphorous than *H. maximilliani* and *T. latifolia*, indicating that once established, this species provides greater bioaccumulation and removal potential than the other species evaluated in this study. Additionally, uptake of nitrogen and phosphorous is significantly affected by multiple harvests. Nutrient mass recovery was significantly higher when *C. microptera*, *H. maximilliani*, or *T. latifolia* were harvested twice-yearly, than when harvested only at end-of-season.

This investigation provides statistical evidence that plant growth, contaminant uptake, and responses to multiple harvests significantly differ among species studied. This information is critical to landscape architects when selecting preferred plant species for use in BR system designs.

# Using InVEST to Evaluate the Performance of Urban Growth Management Strategies in Conserving Ecosystem Services in the Urban Fringe Areas of the City of Corvallis, OR

**Long Zhou** University of Oklahoma  
[long.zhou-1@ou.edu](mailto:long.zhou-1@ou.edu)

The world is undergoing a sustained wave of urbanization and through changing land use and land cover, urbanization has been posing threats to “eco-environments” at various scales (Wang et al 2002). Urban growth management strategies have been widely applied at both local and regional scales in the United States to control urban growth and conserve natural resources (Bengston et al 2003). Scholars have studied the performance of Urban Growth Management in environmental conservation, while the results vary due to different scales and research perspectives (Frenkel, 2004; Nelson 1992; Gordon, et al, 2009; Cathcart, et al 2006; Robinson, et al 2005; Kline and Alig, 1999). Through reviewing relevant literature, the author found that few studies explore this issue based on ecosystem service quantification, which could directly act as an indicator of the extent of environmental conservation under different planning policies (Heldal and Baszka 2012).

The InVEST (Integrated Value of Ecosystem Services Tradeoffs) modeling program developed by the Natural Capital Project at Stanford University quantifies various ecosystem services under different planning scenarios. The City of Corvallis intersects with Willamette River Watershed (HUC 1709000306) and Marys River Watershed (HUC 1709000302) in Central Western Oregon. Willamette River does not meet the water quality standard established by EPA’s Clean Water Act and the City developed the Total Maximum Daily Loads (TMDL) model for the Willamette Basin in 2006. This research uses InVEST to evaluate the City of Corvallis’s Urban Growth Management program in conserving its urban fringe area’s ecological values by quantifying three dimensions of ecosystem service: stormwater retention, stormwater purification and carbon sequestration. Based on the avoided cost analysis, this research proposes a new land valuation system for land uses. The new value system also assigns every undeveloped piece of land at the urban fringe a value that combines the natural land’s assessed property value and the anticipated monetary value in providing ecosystem services in purifying stormwater and storing carbon. Such a system could be used by the City to adjust future development fees in the urban fringe area. In addition, the methodology used in this study could be applied by the Oregon Land Conservation and Development Commission to evaluate the performance of each city’s Urban Growth Management policy of preserving natural resources.

# Marginal Utility: Roadside Vegetation in The Mobile Bay Drainage Area

**Valerie Friedmann** Auburn University

The purpose of this study is to document and define the ecological performance and design potential of plant species and other biotic and abiotic factors commonly found in road rights-of-way in the Mobile Bay Drainage Area (MBDA). The common perception of a right-of-way is a homogenous swath of turf and weedy vegetation; this study seeks to identify the unique performative and spatial latencies in the blurred view from 70 mph.

With a land area of 44,560 square miles, the MBDA delineates a topographically defined region of study that encompasses the majority of Alabama. The MBDA contains approximately 27,200 miles of interstate, highway, arterial, and connector roads with an estimated 620 square miles of adjacent land held in rights-of-way.

Vegetation found along roadways persists in growing conditions that prohibit the growth of many native plant species. Typically perceived as pests, these hardy plants can provide ecological benefits including wildlife and pollinator habitat, erosion control, stormwater infiltration, and particulate and ambient temperature reduction. Designing and managing to maximize this ecological potential, across the immense network of continuous open space that rights-of-way provide, could result in environmental improvements at the regional scale while bolstering the social perception of infrastructural landscapes and the plant species that colonize them.

An initial review of spatial and policy data suggests that additional documentation of existing roadside vegetation and maintenance regimes will benefit the region. With increased development on the horizon, landscape architects and transportation designers should take a proactive and optimistic approach to proposed roadway design and management that encompasses the ecological and social benefits provided by thoughtfully designed contiguous open spaces. Recent federal proposals to enhance the ecological viability of rights-of-way are leading to more recognition of these overlooked landscapes. Landscape architects have a role to play in amplifying the potential of these areas that are marginalized, yet abundant.

This presentation will outline the project's initial findings from fall and winter 2015. The author has identified and driven (twice at the time of this presentation) a route that traverses various eco-regions and land use types while navigating Alabama's political landscape of county lines, vegetation policies, and maintenance regimes. The route will eventually be driven in four seasons while field studies, video footage, and photography will be employed to identify and document vegetation, growing conditions, and the unique design potential at specified mile markers and landmarks.

At this presentation, video and information-rich imagery will communicate initial findings on the existing conditions and opportunities found along the route. An in-progress overview of eco-region specific planting palettes and design parameters will also be discussed.

# Acoustic ecology and the Tzintzuntzan hummingbird habitat restoration

**Brenda J. Brown** University of Manitoba  
[brenda.brown@umanitoba.ca](mailto:brenda.brown@umanitoba.ca)

This multi-media presentation concerns the Tzintzuntzan hummingbird habitat restoration and acoustic ecology's role of in its initial conception and subsequent design development. It demonstrates how engagement with the acoustic environment quickly implicates other disciplines and professions -- in this case ecological restoration, plant ecology, ornithology, archaeology and music -- and indicates areas for further research.

It includes a general introduction to acoustic ecology, referencing writers such as Bernie Krause who documents animal species' sonic niches, and R. Murray Schafer, who, over 35 years ago, called for a new acoustic design practice for our acoustic environment, design made increasingly urgent by humans' pervasive influence on the planet. Landscape historic preservationists' and restorers' accounts of lacunae created by species extinction, alterations to surrounding landscapes' forms and functions, and changes to migration patterns are also briefly recounted.

Tzintzuntzan, an onomatopoeic, Purépecha word, means "place of the hummingbirds". Tzintzuntzan is the former ceremonial capital of the Purépecha, who once ruled the lower valleys of Jalisco and Guanajuato and most of Michoacán. Though some say the site was named for a human clan rather than the birds themselves, there is little dispute that hummingbirds were vital to the pre-Columbian Purépecha; contemporary crafts demonstrate their ongoing significance for that culture. Hummingbirds now have little presence at the Tzintzuntzan site however.

The presentation traces the ongoing project's evolution. The initial conception was driven by the sounds and habits of the 15+ hummingbird species potentially inhabiting this part of Mexico's trans-volcanic belt. As these different species belong to different guilds and have different voices, spaces and plantings would be orchestrated to create particular sequential spatial and acoustic experiences. However, in subsequent research and consultation with the team's restoration ecologist and ornithologist it emerged that these species' interactions in such a designed environment are currently unknown -- and unstudied. We need to do that research ourselves. Thus, while the designs created for the project are based on extensive research and best current knowledge on native plants and hummingbirds' needs and behaviors, the project is necessarily more experimental than first conceived.

The originally imagined spatio-acoustic design was premature, yet an enriched acoustic landscape will almost certainly emerge together with the more ecologically diverse one. Pre-planting surveys and subsequent monitoring of effects of the design's plants, their relative configurations, and the hummingbird species' responses and interactions, will ground the sort of more complex landscape orchestrations that initially inspired the project.

# An ecological greenway studio planning and design process using wildlife habitat relationship (WHR) models for three case studies of rivers in the Central Valley of California

**Steven E. Greco** University of California, Davis  
[segreco@ucdavis.edu](mailto:segreco@ucdavis.edu)

To describe an 'ecological greenway' design process using WHR models within a landscape planning and design studio context by examining three river case studies. WHR modeling is species-specific information that links vegetation communities, and their structure, to wildlife species suitability models (Beck and Suring 2009). Without incorporating WHR models to predict functionality for wildlife species of concern (e.g. threatened or endangered) it is unlikely the greenway will function for them. For example, the ecological greenway design process described by Hellmund and Smith (2006) does not incorporate WHR models. A dilemma in greenway planning is justifying the width. Herein width is governed by ecological function: a migration corridor for deer and habitat for endangered species. Each river is situated within a primarily agricultural landscape matrix and none function as a deer migration corridor. Each river's floodplain is significantly fragmented and constrained by human land uses. The goals of the projects were to enhance and restore ecological functionality and provide limited-impact human recreation (e.g. hiking and biking).

Students implemented an integrated dual-track design process, one track focused on natural systems and the other on cultural systems. An emphasis within natural systems was conservation planning and design using a set of 'focal species'; one of which was a wide ranging and seasonally migrating ungulate to create an "umbrella effect." To design habitat areas for each focal species, a California-specific WHR system was utilized (Mayer and Laudenslayer 1988). Local open space, cultural history, and recreational goals formed the basis of the cultural systems design process. Students created a GIS database for each case study by collecting a variety of GIS data layers including land use, land cover, roads, 100-year floodplain, and soils. Techniques utilizing GIS, CAD, and illustration software were combined to create site analyses and master plans.

Master plan designs were dependent on the individual river systems but had many commonalities in their landscape patterns due to the common criterion of creating a deer migration corridor. Phasing of the alignment width was key to achieving ecological functionality in the long-term. GIS was used effectively to communicate phasing in an animated sequence.

Ecological greenways are important habitat resources for wildlife in culturally-dominated landscapes, especially where migrating or endangered species are present. The use of WHR models is important to the design process to ensure the landscape patterns of the greenway function for the wildlife species it was designed for.



# Specifying prescribed fire for habitat, restoration, and regeneration: Leadership demonstrated in the Southeastern US

**Vaike Haas** West Virginia University  
[vaike.haas@mail.wvu.edu](mailto:vaike.haas@mail.wvu.edu)

Landscape architects have a role to play in prescribing fire. While the responsibility of detailed burn prescriptions rests with an experienced burn boss, an understanding of the landscape effects of fire frequency, season, and fuel conditions will help landscape architects recommend the most effective management strategies for large scale restoration projects, influence public opinion, and help prioritize when and how prescribed fire should be applied in order to recreate self-sustaining landscapes. Landscape architects can outline both management and monitoring practices to fine-tune fire prescriptions, and through thoughtful site design make understanding the trial and error process of prescribed fire as transparent and accessible as possible.

Although prescribed burning has gathered momentum since the late 1970s, all Agencies applied prescribed fire to only 2.0 million acres of the US in 2015. This was during an especially active wildfire season, which saw 9.8 million acres burn. In other words, 83% of fire on the ground in the US in 2015 was unplanned and unprescribed. Most prescribed fire was applied within the Southern region (1.3 million acres).

Agencies in Florida try to burn 1 million acres a year (personal communication, Billy Taylor, Wakulla State Forest). As a result of strong public support, a very active prescribed fire program, and long-term studies at Tall Timbers Research Station, researchers found the optimum seasonality and fire frequency for burning in long-leaf pine forests in Florida to be every 1.5-2.5 years in spring or summer. Fire intervals longer than 3 years slowly succeed to hardwood forest, in time looking no different than unburned areas; but a 1-year fire interval is too short for understory vegetation to establish. Growing season burns mimicked most closely the historic fire pattern, as lightning strikes initiated many of the fires historically. St. Mark's National Wildlife Refuge in northwest Florida established demonstration areas where trails intersect four corners of burn treatments to demonstrate to the public the effect of seasonality on prescribed burns, as well as a control area no burning. This was similar to the experiments designed at Tall Timbers Research Station, but readily accessible to the public and within a short walk of the nature center.

This poster presentation outlines recent prescribed fire efforts in Florida, including the successful demonstration areas at Tall Timbers and St. Marks Wilderness Preserve, for landscape architects looking to prescribe fire as a land management tool.

# Wet Studies in a Dry State

**Tim Keane** Kansas State University  
[whisker@ksu.edu](mailto:whisker@ksu.edu)

Semi-arid rangeland ecosystems are unique blends of components and processes resulting in various patterns of form and function. These grasslands, many of which are in state or federal holding, have often been overgrazed and made vulnerable to invasion by annual grasses and noxious weeds markedly reducing their sustainable productivity. Climate change looks to present future threats as well. Holistic or ecosystem ranch management strategies aim to regain stability and resilience in these abused rangelands through restoration of native biota, hydrology, and grazing regimes. Water and its movement across and through the land is one of the most diagnostic components indicative of ecosystem, or land health, thus by studying the hydrology we can track the impacts of changed management approaches.

In 2010 I developed an assessment and monitoring protocol to measure and quantify the hydrologic impacts of holistic ranch management on the Ucross Ranch located in Powder River Basin of NE Wyoming. We have completed four years of the ten-year plan to install and monitor stream and upland gully sites. Already we see evidence of stream channel adjustment processes which should guide restoration of riparian gallery forest species. Sustained observation and measurement of perennial stream sites, upland gullies and ephemeral draws on the 22,000 acre Ucross Ranch will allow correlation of climatic variation, land-use practices, and subsequent landscape change. Basin-scale measures also allow the coordinated study of connected resources such as upland vegetation, upland erosional and mass movement processes, soil development, habitat (both aquatic and terrestrial) potential and change, and the impacts of both short and long-term climatic variation. The Apache/Ucross sites will provide valuable information in the coming decades to the sciences of fluvial geomorphology and rangeland ecology. To understand these long term changes in process and resultant form we seek long term access to study sites and long term partnership between researchers and funding organizations all in the interest of maintaining the health and viability of the landscapes that we inhabit, utilize and depend upon.

This presentation will demonstrate how review and analyses of data collected at the Ucross sites will be a key component in monitoring and evaluating the efficacy of holistic ranch management practices at the ranch and in the rangeland basins of the Inter-mountain West. Also addressed will be additional research opportunities presented by our initial efforts in NE Wyoming.

This work has been graciously supported by the Apache Foundation, current managers of the Ucross Ranch.

# Using phenomenology to increase biological identity and the sensory experience

**Gabriela Arevalo** Auburn University  
[gea0003@auburn.edu](mailto:gea0003@auburn.edu)

**Charlene Lebleu** Auburn University  
[leblecm@auburn.edu](mailto:leblecm@auburn.edu)

The purpose of this paper is to describe and assess how phenomenology can fashion an assembly of systems, nodes and links to increase the sensory experience of human beings. The role and experience of phenomena is examined at multiple scales, and how it can lead humans to a better understanding of landscape ecosystems, natural processes, and biological identity.

This paper explores three main topics: First, to create a grounding concept about the city and its systems, ideas related to Ecological Urbanism are analyzed and exposed. Secondly, it explains the theory of Phenomenology, embodiment and microclimate and how it can relate to ecological systems within the city. Additionally, it unfolds the idea of Space and Place and how landscape relates to identity. Two case studies are presented to confirm findings and evaluate the importance of the experience of phenomena in Landscape Architecture practice.

Nowadays cities don't make legible how ecological systems coexist with man-made infrastructures. Therefore, people are not aware of the possible interactions with the natural environment. Nodes that will draw people into natural ecosystems are necessary. This paper uses Ecological Urbanism as the basis to explore the idea. Christopher Gray says "Ecological urbanism suggests that design is the key to balancing the conflicts between ecology and the overt consumption of urbanism" (Gray, 2011). The question is how does phenomenology take place in the urban environment and why is it important? Christian Norberg-Schulz says that "Phenomenology is the act of defining the boundaries that create specific identity." (Norberg-Schulz, 2015). Therefore, Phenomenology can have an important role in enhancing sensory perception and biological identity within the city. Moreover, nodes where different systems interact create a rich set of experiences that can be designed to generate a sense of place and a unique atmosphere.

The paper concludes in a discussion on concise findings such as: How a node can be designed to increase experience of phenomena within the city? What is the make-up of these nodes? Is there a hierarchy within the system of nodes? Can the network have different characters and express phenomenology in different ways? There are several studies about systems and the city, but the gap that this paper proposes, lies on the idea that design at these nodes can increase the experience of phenomena for the user, leading to a better understanding of landscape, ecosystems, natural processes and biological identity.

# Alternative Futures for the Rural Intermountain West: Case study of the San Rafael River Basin in southern Utah

**Barty Warren-Kretzschmar** Utah State University

**Richard Toth** Utah State University

**Carly Klein** Utah State University

**Stephanie Tomlin** Utah State University

Many communities in rural Utah face the challenge of making decisions about sustainable landscape development in a time of economic uncertainty, societal shifts and climatic changes, i.e. drought and severe storms (Chambers & Wisdom 2009). Such decisions must reflect landscape level issues such as extractive energy, residential development, agriculture, wildlife conservation, and tourism, as well as landscape resources such as water quality and quantity, air quality, and sensitive habitats. Furthermore, recommendations must address the complex pattern of land ownership found in the Intermountain West. (Rasker 2006)

In the San Rafael River Basin (SRRB) case study, a bioregional planning approach was used to analyze and address the socio-economic and environmental issues of the watershed. The SRRB watershed is in south-central Utah and encompasses mountain and high desert habitats as well as historical petroglyphs and unique geological formations of the San Rafael Swell. This area also faces economic challenges and the migration of younger residents to urban centers. Coal extraction and the generation of electrical power are major economic drivers. However, the declines in coal production, economically unsustainable agricultural and limited water resources are pressing issues that face the region (Baker et al. 2014). Furthermore, a political debate surrounds the conservation and multiple use of the San Rafael Swell which contains exquisite canyons as well as several wilderness study areas (Prettyman 2014).

The goal of the study was to develop future scenarios for the region that address the interdependencies of critical physical, biological and cultural factors in the watershed. Based on stakeholder input, students developed four alternative futures: “Business as Usual”, “Heritage Communities”, “Recreation Hub”, “Diverse Energy Solutions”. Environmental evaluation models were developed that assessed the fitness of the land use scenarios on hydrology; wildlife; extractive resources; health, safety and welfare; working lands (grazing and agriculture) and sense of place. Stakeholder feedback identified the “Diverse energy solutions” as the most viable of the alternative futures.

The merit of the study is to provide stakeholders and policy makers in the SRRB not only with data for future land use decisions, but also to expand visions for the region. Educationally, the bioregional planning study integrates science and design principles into a framework to help students understand regional biophysical, cultural and economic attributes. This approach requires students to rely on cross-discipline research and stakeholder collaboration to identify and spatially represent components of the landscape. The bioregional planning process is transferable across science and design disciplines.

# Integrating water and land use planning for wildlife habitat conservation

**Shujuan Li** Utah State University

**Bo Yang** Utah State University

**Joanna Endter-Wada** Utah State University

**Enjie Li** Utah State University

Focusing on human needs, urban planning activities are changing the linkages between water and land. Land is generally perceived as stable and the geographic basis for urban development. In contrast, water is considered as fluid and a marketable resource to be channeled to the land in support of urban growth. Unlike human beings, wildlife cannot move water to the land to satisfy their needs. Considering that many wildlife species' survival depends on the natural hydrologic conditions, unintended consequences can occur when natural water flow is interrupted by human management. This study explores the integration of water and land in urban planning, and evaluates the impacts of urban growth on wildlife habitats, using Cache County, Utah as the study site. Fifteen different wildlife species are selected based on a set of criteria. Habitat Suitability Index models are used to determine the suitable habitat areas for each species. GIS is used to map the habitat areas based on various datasets (e.g., vegetation cover). Three types of habitat (*critical*, *important*, and *marginal*) are identified through an overlay analysis of all the fifteen species' habitat maps. SLEUTH, a probabilistic cellular automata model, is used to simulate future urban growth and land use changes. Three growth scenarios (current trends, compact growth, and water-smart growth) are developed, with the "current trend" scenario serving as the baseline condition. The results show that no single scenario can resolve all the conflicts between water resource protection, urban growth, and wildlife habitat preservation. The "current trend" scenario can result in the most acreage in conflicting with all the three types of habitat aforementioned. The "compact growth" scenario presents the best case in protecting the *critical habitat*, but at the cost of losing a large amount of *important habitat*. This scenario does not consider water resource protection either. The "water-smart growth" scenario results in the smallest area expansion for urban development among the three scenarios examined. However, the expansion areas are not in the ideal locations—more than twice of the *critical habitat* would be lost under the "water-smart growth" scenario, compared with the "compact growth" scenario. Nevertheless, the "water-smart growth" remains the best scenario with respect to water resource protection. Climate change will likely change the existing linkages between water and land. Hence, balancing urban development and habitat protection will be an even challenging dilemma faced by not only Cache County, Utah, but also other urban areas in the West.

# Four Coasts: Exploring the Regional Contentions of Dredging and Sediment Management

**Sean Burkholder** University of Buffalo

**Brian Davis** Cornell University

**Gale Fulton** University of Tennessee at Knoxville

**Rob Holmes** University of Florida

**Brett Milligan** Washington University

While landscape architects have historically understood the necessary requirements for addressing sediment on any given project, this generally takes the form of a set of nationally-accepted, land-based best management practices, designed to reduce erosion at the scale of the site. Larger scales of sediment management, such as the regional sediment flows that the Army Corps of Engineers manages in regions like the Great Lakes Basin and Mississippi River Delta, and more intentional forms of earthmoving, such as the dredging implicated in those regional flows, are seldom considered by landscape architects, despite the fact these human accelerations of sediment make and alter landscapes of great potential ecological, economic, and even cultural significance. Focusing on dredging and related practices, this panel will present the importance of sediment management as a landscape infrastructural practice that foregrounds soil and sediment as fundamental elements of the design and planning of landscape.

There are strong regional differences in the way sediment flows, how it can be used, and how it is transported. These variations are the products of geologic conditions, land-use practices, hydrologic regimes, and federal and state regulations. This interconnected web results in contentious and sometimes productive battles between design professionals, policy makers, community members, shipping industry representatives, and government officials that shape huge swaths of coastal and riverine landscapes across the country. This panel is composed of members of the Dredge Research Collaborative, an organization that has curated three trans-disciplinary symposiums and organized multiple design workshops on these topics. It will explore four regions of the United States and the distinctive characteristics of sediment management in each.

Deltas (Gulf and Pacific) - Brett Milligan

Florida - Rob Holmes

New York - Brian Davis

Great Lakes - Sean Burkholder

Moderator- Gale Fulton

Each panelist will outline the large-scale sediment-related issues of a region, discuss how sediment management regimes are choreographed to address these issues, and draw connections to related environmental issues of importance to landscape planning and design, including impacts of anthropogenically-accelerated climate change, coastal restoration, and regional habitat networks. Panelists will use the contentions surrounding sediment management in their given region to discuss leverage points for the profession of landscape architecture to engage the landscapes produced and affected by dredging and other forms of sediment management.

# Landscape Changes in the Mekong River Basin: Effects of Multiple HydroElectric Dams on the River Channel, Delta, and Fishery

**G. Mathias Kondolf** University of California

**Zan Rubin** University of California

The Mekong River is unique in the world in its geographic and ecological setting, with over 60 million people obtaining their main source of protein from the river's fisheries. The basin is now undergoing rapid development, including expansion of road networks, timber harvest, and dyking of floodplains, resulting in massive transformation of the landscape and impending extinction of sensitive species, such as the Mekong river dolphin. Despite their ecological and human importance, the river and its tributaries are undergoing rapid dam construction for hydroelectricity to be exported to neighboring markets. Seven mainstem dams in upper basin in China and 133 mainstem and tributary dams in Laos, Thailand, Cambodia, and Vietnam are completed or proposed. These dams would transform most of the Mekong system from free-flowing rivers to a set of reservoirs, altering the river ecology from lotic to lentic, and blocking migration of fish to their natal spawning areas. The dams will trap sediment, depriving the downstream river and delta of their natural sediment load. To predict the net sediment trapping from existing and future proposed dams, we developed geomorphically-based estimates of sediment yield and applied the 3W model to calculate cumulative sediment starvation, using methods and data improved over prior such estimates. Our results indicate that the 133 dams built as planned would trap 96% of the river's former sediment supply to the delta (vs. prior estimates of 50-75%). The downstream impacts of this sediment-starved water in the river will be erosion of thin sediment deposits from bedrock reaches, incision of the alluvial riverbed downstream, and accelerated erosion of the delta in response to the virtual elimination of its sediment supply. The impacts of dam-induced sediment starvation could be partially mitigated by implementing strategies to pass sediment through or around dams. These include sediment sluicing (drawing down the reservoir during floods to pass sediment-laden waters through the dam), flushing already-deposited sediments through the dam, venting of density currents through dam outlets, and passing sediment around the reservoir entirely through a bypass channel. Most of these technologies work better on reservoirs whose storage capacity is a small percentage of the mean annual flow, and on long, narrow reservoirs on steep-gradient rivers. Our team is currently working with staff of Laotian and Cambodian ministries to identify opportunities to relocate/redesign dams to make such sustainable sediment management feasible, and in at least one important case, to permit fish passage around the dam.

# Assessing habitat suitability of Günther's frog (*Hylarana guentheri*) in an agricultural landscape

**Chen-Fa Wu** National Chung Hsing University

**Shin-Ruoh Juang** National Chung Hsing University

**Szu-Hung Chen** Texas A&M University

Previous studies have indicated that roughly half of known amphibians worldwide are facing population declines and extinction risk. Habitat loss related to human activities are considered one of impact factors strongly correlated with high threat risk. Farm pond is an important habitat for amphibians, birds, and other wildlife. In Taiwan, artificial ponds are originally created on farmlands for irrigation purposes and resident's livelihood water. Although creating ponds is a typical farming practice, it also provides habitats for pond-breeding amphibians. Thus, it is essential to understand current status of habitats and its vulnerability regarding urgent conservation needs for target species. Günther's frog as a pond-breeding amphibian show highly sensitivity toward surrounding environmental changes, which can be used as an indicator species to access habitat suitability. The purpose of this study is establish a systematic framework for accessing habitat suitability of pond-breeding amphibians and residents' awareness of habitat conservation regarding the vulnerability by selecting Günther's frog as a pilot-study species. First, we collected frog survey data in Chiayi, Taiwan from winter of 2013 to spring of 2014, including specie richness and abundance, and also investigated current status of environmental conditions around ponds(e.g., water depth). Then, expert questionnaires and the Fuzzy Delphi method were applied to establish the hierarchical evaluating criteria of habitat suitability assessment. Four indicators, such as aquatic environments of farm pond, terrestrial environments around ponds, landscape connectivity, and resident's conservation perception, were determined as first-layer factors of the assessment criteria while other ten indicators were defined as second-layer factors (e.g., landscape connectivity-distance to farm pond). Based on established assessment criteria, we performed *in-situ* habitat suitability evaluation on selected sites and surveyed residents' perception by questionnaires. Finally, expert-knowledge approach and matrix analysis were used to integrate and convert all results into three key indices-- Exposure, Sensitivity, and Adaptive capacity, which addressed habitat suitability from the vulnerability perspective. Results has suggested that 19 percent locations showed high frog species richness and were with high habitat suitability as well. However, 67 percent locations show signs of habitat degradation, which should implement habitat improvement practices in order to restore frog population. In brief, the proposed method can be applied not only to assess frog habitat sustainability and degradation risks but also to determine which locations may need to more attention regarding conservation implementation. It can be also implicated to evaluate other amphibians and bird species in an agricultural landscape. Furthermore, findings in this study provide useful background knowledge to all associated stakeholders (e.g., government agency, local developer, conservation biologist) when designing and implementing plans of wildlife habitat management and restoration for farm pond environments.



# Urban Riverside Ecology and Biodiversity

**Chia-Ching Wu** National Taiwan University  
[r03628313@ntu.edu.tw](mailto:r03628313@ntu.edu.tw)

**Chen-Yen Chang** National Taiwan University  
[cycmail@ntu.edu.tw](mailto:cycmail@ntu.edu.tw)

Riparian area, which the areas next to rivers with various land cover types are significant habitats for local species (Pennington, Hansel & Blair, 2008; Pennington & Blair, 2011; Bueno, Bruno, Pimentel, Sanaïotti & Magnusson, 2012), hence, riverside parks are one of the most important components of green infrastructure (GI) in urban areas. Riverside parks can be described in terms of landscape matrix characteristics (Fernandes, Aguiar, Ferreira, 2011). Some researches suggested that biodiversity of an environment can be predicted by certain landscape structure characteristic (Forman, Galli & Leck, 1976; Pennington & Blair, 2011; Atauri & de Lucio, 2001; Schindler, Poirazidis, Wrbka, 2008; Atauri & de Lucio, 2001; Saïd & Servanty, 2005). But we know little about the landscape structure characteristic with the best bird species diversity predictability. This research begins to close this gap by examining the relationship between riverside parks landscape structures and bird species diversity that vary in terms of the matrix categories.

We use the Point Count method of measuring bird diversity as our indicator of biodiversity, including number of species, total number, Shannon diversity index, and evenness index. The sites situate along Tamsui River to Hsintian Creek, Dahan Creek, Waishuang Creek and Keelung River within Taipei city and New Taipei city in Taiwan. The research sites are selected and classified by different proportions of the land cover types, including tree, water, grass and pavement. By using landscape matrix, we can describe the composition and configuration of landscape structures of the research sites. We use Google map, eCognition and Arc GIS to digitize the aerial photograph and calculate the landscape matrix with the software, Fragstats.

We anticipate that we will be able to define the landscape structure types that optimize the benefits to the ecology of the area. Also, we will be able to define the landscape metrics which are relevant to urban GI environment in order to apply the metrics into design field. It can help planning riparian areas appropriately and increasing the biodiversity in similar GI in the future.

Now, we completed the research structure and the methodology, by the time of the conference, we will finish the site selection, and hopefully start to perform bird survey, quantify the aerial photograph and have primary result for discussion.

# Marshes, Muck + a Monoculture; Approaching the Issue of *Phragmites australis* in Saginaw Bay

**Karen Lutsky** University at Buffalo - SUNY  
[karen.lutsky@gmail.com](mailto:karen.lutsky@gmail.com)

The Saginaw Bay is a 1,143 square mile shallow bowl carved along Michigan's Lake Huron shoreline. The bay's flat, gradual bathymetry has helped establish an edge condition that supports the country's largest contiguous freshwater marsh. Like many of the Great Lakes' marshes, this site was drained and settled by heavy industry, agriculture, and development in the early 20th century. The effects of this settlement by way of inundating the bay with toxic chemicals, heavy metals and other industrial and agricultural waste helped establish the Bay as an AOC (Areas of Concern) in 1987.

Recent decades of low water levels have begun to uncover new territory in the Bay. Seemingly a potential opportunity to reinstate lost marsh acreage, the emergent land along with the majority of the coastal marshes are now largely defined by a singular species; *Phragmites australis*. Local authorities and organizations, such as the Michigan Department of Environmental Quality, the Saginaw Bay Land Conservancy Organization, and Duck Unlimited have focused much attention on methods of *Phragmites* management and eradication including an over 150 acre *Phragmites* Control and Restoration Demonstration project. While some efforts have been successful, many efforts have proven inadequate in their long term management and control. Considering though the breadth and intensity of *Phragmites* within the Bay, along with its larger issues of contamination, the situation in the Saginaw Bay seems prime for the growth of a new discussion about *Phragmites* in the U.S. ; a discussion that more objectively considers this plant's ability to vigorously grow and create habitat on contaminated land, phytoremediation capabilities, and high biomass production that could be used for everything from fuel to building materials.

This talk will speak to the dilemma of the 'invasive species' versus the 'vast contaminated site'. It will introduce approaches in utilization and management of *Phragmites* adopted in other countries where there is less of a stigma associated with the plant and how landscape architects might engage the public in recognizing the design potential of *Phragmites* as a material to be worked 'with' and not 'against' in carefully considered situations. Findings will also be presented by way of student proposals resulting from an advanced landscape architecture graduate studio studying this site and topic.

# Agri-Coastal: Reimagining Nutrient Dynamics in the Mississippi River Delta

**Forbes Lipschitz** Louisiana State University

[flipschitz@lsu.edu](mailto:flipschitz@lsu.edu)

Every summer, hypoxia – defined as dissolved oxygen below 2 mg/L – threatens the economic and ecological vitality of the northern Gulf of Mexico. Excessive nutrients, primarily from agricultural inputs, flow from the Mississippi-Atchafalaya River Basin into the northern Gulf of Mexico, where they deplete oxygen levels and cause seasonal “dead zones.” The continental scale of nutrient loading, coupled with conflicting needs of agricultural production and coastal ecologies, cannot be addressed by a singular technological solution. To effectively mitigate coastal eutrophication, we must effectively communicate the scale and complexity of the problem, while coordinating across multiple disciplines spanning distant regions. Landscape architecture is uniquely positioned to address these concerns.

The paradigm of agricultural runoff and coastal eutrophication should be reclaimed as a design project. The agricultural landscape has figured prominently in design discourse - from Ebenezer Howard’s Garden City to Patrick Geddes Rural-to-Urban Transect to Ian McHarg’s Design with Nature. Coastal landscapes have been similarly well studied, particularly in light of climate change and global sea level rise. What is needed is a synthetic approach to continental drainage systems whereby upland rural and urban systems support rather than suppress downstream coastal ecologies. A range of contemporary projects in both professional and academic realms – from tile drainage wetlands in Illinois to algal turf scrubbers in Baltimore - showcase that landscape architects are answering this call, engaging nutrient systems in both practical and imaginative ways.

This study, funded by the Louisiana State University Coastal Sustainability Studio, builds upon a planning-scale studio investigation and interdisciplinary design charrette exploring nutrient and hydrological dynamics in the Mississippi-Atchafalaya River Basin. This region an ideal testing ground because the Mississippi River has the third largest drainage basin in the world, draining 41 percent of the contiguous United States. The basin is the most productive agricultural region in the country and also acts as a vital migration corridor for 60 percent of North America's bird species, in addition to providing critical habitat for a variety of terrestrial species including the rare Louisiana black bear. Mapping agricultural and ecological systems in the basin helps identify potential testing sites for integrating ecological parameters into nutrient management systems. The speculative design and management strategies build on projects like the Mississippi River Basin Healthy Watersheds Initiative and the Hypoxia Task Force – attempting to minimize nutrient runoff, while achieving the best outcomes for agriculture, ecosystem services, and sustainable community development.

# Advancing Coastal Marine Planning

**Charlene LeBleu** Auburn University  
[leblecm@auburn.edu](mailto:leblecm@auburn.edu)

**Rebecca Retzlaff** Auburn University  
[rcr0001@auburn.edu](mailto:rcr0001@auburn.edu)

**Joshua Cameron** Auburn University  
[jlc0060@tigermail.auburn.edu](mailto:jlc0060@tigermail.auburn.edu)

The process for defining a Coastal Marine Planning (CMP) for the State of Alabama began in 2012 and includes two Alabama coastal counties, Baldwin County and Mobile County. This planning currently exist as a themed spatial GIS inventory that falls at and below the continuous 10-foot contour, and adjoining State water bottoms continuing 200 miles offshore into Federal waters. The thematic (vector and raster) management, development, and modifications for this project utilizes Environmental Systems Research Institutes, Inc. (ESRI®) ArcGIS®, as well as, extensions and tools for project development or assessing data including ArcGIS Spatial Analyst and other analysis tools. The integration of the current CMP themed spatial GIS inventory integrates with existing traditional terrestrial land use coastal planning through mapping overlays.

This paper focuses on the social and cultural dimensions to the CMP inventory including working waterfront, general historic, archaeological, and shipwrecks. The Geographic Information Systems (GIS) data mining includes theme data formatting, data Input, database creation and management, identification of data gaps, metadata management, and web publishing. Task included: 1) GIS data review (coordinate with past efforts)--Provide additional CMP themed spatial GIS inventory layers to include additional social and cultural dimensions to the CMP inventory including (but not limited to) commercial fishing, general historic, archaeological, working waterfront and shipwrecks; 2) Stakeholder engagement—City of Mobile, Alabama Working Waterfront Coalition; Commercial fishing groups; U.S. Army Corps of Engineers and the Alabama Historic Commission; 3) Development of GIS viewer tool for public use (Extents)--Mobile Bay, Mobile County, AL shoreline and Baldwin County, AL shoreline (10 ‘contour) to Federal waters; and 4) Access tool functionality--Assemble GIS Viewer for public viewing, and test tool on stakeholders

The project engaged three public meetings in Mobile and Baldwin County Alabama to educate and inform the public, government officials, and resource managers about the concept of the CMP and the GIS Viewer, its connection to land use planning, and the impact and potential to protect economic interest and coastal habitat and ecosystems. Participants in public meetings engaged the GIS viewer to better understand conflicts of use along the Alabama coast. Support partners, stakeholders and community action groups assisted in forming a path for further dialog over conflicts of interest that may lead to future resiliency and economic growth. Stakeholders outside of the project area have shown interest in learning how to implement of such a system, and take the information back to their own communities.

# Geomorphic Results of Urbanization on Inner-Bluegrass Streams

**Christopher Sass** University of Kentucky  
[chris.sass@uky.edu](mailto:chris.sass@uky.edu)

**Morgan Dunay** University of Kentucky  
[morgandunay516@uky.edu](mailto:morgandunay516@uky.edu)

**Michelle Hunerkoch** University of Kentucky  
[michelle.lyonette@uky.edu](mailto:michelle.lyonette@uky.edu)

Effects from urbanization on streams can be difficult to recognize or assess without quantifiable measures. Comments such as, “This stream hasn’t changed in years,” are obviously not correct. Government agencies and private groups, such as Trout Unlimited, have spent billions of dollars to rehabilitate streams (Bernhardt et al. 2005) and decrease the effects of urbanization on streams through BMPs. The overarching goal of this study was to establish monitored sites of urban effected streams within Kentucky’s Inner-Bluegrass Region, specifically in Lexington, Kentucky. We attempt to document how the effects of urbanization influence a streams’ geomorphic character and how those characters have changed from the historical conditions. Four reaches were established over the summer of 2014 and were re-measured during the summer of 2015. Three additional reaches were established during the summer of 2015. These reaches represent different riparian variables and flow regimes in varied urban watersheds. Sites consisted of low riparian vegetation and ephemeral flow, high riparian vegetation and ephemeral flow, low riparian vegetation perennial flow, and high riparian vegetation with perennial flow. Initial establishment of selected reaches included longitudinal profiles, pool and riffle cross-sections, and pebble counts, which were classified according to Rosgen’s stream classification system (Rosgen 1996). Once establishment was completed, we began to process data, research stream movement through the landscape, establish stream classification, and compare past and present geomorphic characteristics. We assessed stream migration in Lexington using historical aerial photographs from 1937, 1949, 1952, 1956, 1966, 1973, 1982, 1993, 1997 and 1998 through the aid of ArcGIS. Over the course of the summer research period, we measured and monitored erosion and changes to the stream channels (Sass and Keane 2012, Rosgen 1996, Harrelson et al. 1994). These urban streams tended to be entrenched, straighter, and wider than they once were, encouraging higher stream flow velocities. Over time, these higher velocities increased stream channel migration and erosion. As the monitoring continues, we expect to obtain results illustrating that streams in the Inner-Bluegrass region function much differently today than in the past and from other regions and that this research will influence stream channel design parameters in this Ecoregion.

# A strategy for locating constructed wetlands as part of a watershed management plan

**Miran Jung Day** California Polytechnic State University

**David Kovacic** University of Illinois Urbana-Champaign

This paper presents the Lake Bloomington Watershed Project as a case study for the feasibility of locating constructed wetlands to improve water quality of Lake Bloomington, Illinois using Geographic Information Systems.

The diminishing quality of drinking water in Bloomington, Illinois is one of the water challenges many Midwest communities that receive their water from streams draining agricultural watersheds face. Lake Bloomington historically exceeds EPA's drinking water standard of 10 ppm for nitrates and is listed as impaired due to excessive nitrate and phosphorus loadings (IEPA, 2006). Similar to many drinking water reservoirs throughout the Midwest, tile drainage is a major cause of nitrate loading in Lake Bloomington (LBWP, 2008). Research has shown that wetlands are one of the most effective practices removing the tile nitrate load (Crumpton et al., 2008; Kovacic et al., 2006). These studies indicated that the strategically located wetlands establishment are critical and urgently needed.

Approximately 1,000 acres of constructed wetlands are theoretically needed to treat the water with nitrate load flowing from the entire Lake Bloomington watershed through the surface and subsurface. The project proposes relatively smaller size wetlands to be strategically located throughout the watershed close to targeted areas considering effectiveness of the management practices and implementation. The study aims to identify and connect current monitoring activities to geographic locations to comprehend data gathered within the watershed. It is also to explore hydrological characteristics and patterns to locate surface and subsurface drainage locations. Lastly it is to develop a framework to identify suitable locations utilizing the data and characteristics of landscape in the watershed. The study, first, develops its own identification system for basin models utilizing current hydrologic unit codes (HUC) to systemically link between the current scientific data and geographical locations. Next, the study creates a hydrological model for the Lake Bloomington watershed using historical data and digital elevation model (DEM) to find preliminary wetland locations reflecting the site conditions. Once preliminary locations are identified, the study also utilizes other factors affecting creation of the constructed wetland on the targeted location accepting surface and subsurface water.

The study provides guidelines for a feasibility study of small constructed wetland sites. It also offers additional support for the water quality management research and particularly contributes to feasibility studies for water quality improvement practices in other agricultural settings in the Midwest.

# PEOPLE-ENVIRONMENT RELATIONSHIPS



# “Psychological park accessibility”: A literature review of perceptual components affecting park use”

**Keunhyun Park** University of Utah  
[healer02@gmail.com](mailto:healer02@gmail.com)

Traditional park accessibility studies mainly focusing on physical distance have critical limitations that proximity cannot solely predict actual park use, and contemporary cities do not have enough land for more parks. The concept of accessibility implies both subjective and objective dimensions and recent studies found that perception of accessibility also affects travel behavior or physical activity. However, the current understanding of the relationship between park accessibility and actual park use is limited, especially with regard to the psychological dimension, and there is a lack of efficient and integrated methods to analyze the perception of park accessibility.

Defining ‘psychological park accessibility’ as perceptual components influencing on park use, this study examines the factors constituting psychological park accessibility and measurement methods through a systematic literature review. The search keywords are chosen as ‘park accessibility’, ‘perception (or preference, barriers)’, and ‘park use’ while ‘green space’, ‘open space’, or ‘recreational facility’ is also used instead of ‘park’, and the outcomes of reviewed studies such as research setting, method, variables, and findings are analyzed and interpreted. This article finds that psychological park accessibility consists of perception of distance, park quality, and neighborhood environments and that subfactors could be measured either quantitatively or qualitatively. Perceived accessibility is even discussed as a more reliable predictor of people’s intention to use parks than objectively measured proximity. Based on a conceptual framework of this study and future empirical tests, scholars could analyze park accessibility with better measurements predicting actual park use and planners could find a better way to improve park accessibility other than just building more parks.



# Creating Outdoor Play Environments which Support the Social Interactions of Children with Autism Spectrum Disorder

**Keith M Christensen** Utah State University  
[keith.christensen@usu.edu](mailto:keith.christensen@usu.edu)

**Laura Patricia Reyes Romero** Utah State University  
[laurareyes29@gmail.com](mailto:laurareyes29@gmail.com)

Autism Spectrum Disorder (ASD) is a developmental disorder characterized by impairments in social interaction and gestural communication. Various play-based interventions have been used to help children with autism develop social skills, including direct teaching strategies. Interventions that consider how children play instead of the final outcome of the play session seem to be more effective in addressing each child's needs, but because children with autism display a large range of variability the results of play interventions are usually very unpredictable. Research suggests that play environments for children with ASD need to be structured in order to be effective. In the absence of well-structured environments structured teaching strategies are often used. However, well-designed outdoor play environments may provide the necessary structure to support social interactions, creating an important place where children with ASD can learn social skills through play. Yet there is little understanding of the design of outdoor play environments which support the social skills development of children with ASD.

The purpose of this study is to examine evidence-based outdoor play environment design strategies which support the social skills development of children with ASD.

To do so, a review of the literature involving children with ASD, outdoor play environments, and social skill development was conducted. Google Scholar and EBSCOHost were the main electronic databases searched. While the original study intent was to identify and document empirically based studies of children with ASD's play behavior in outdoor environments, it quickly became apparent that there is an absence of support for empirical evidence-based design strategies supporting these behaviors. As a result, the focus evolved to developing best practices for the design of outdoor play environments by identifying the atypical play behaviors of children with ASD. The numerous studies examining the play behaviors of children with ASD can be categorized into four primary areas of impacted development: low motor skills and coordination, sensory integration, generative play, and joint attention. This presentation, and accompanying paper, will present related studies describing the impact of characteristics of the environment on low motor skills and coordination, sensory integration, generative play, and joint attention.

Addressing these four play behaviors in the design of the outdoor play environments likely plays an important role in creating spontaneous and pleasurable play opportunities for children with ASD, and may well support social interactions, creating an important place where children with ASD can develop social skills through play.

# THE EDIBLE ACADEMY: Learning from the Rome Sustainable Food Project

**Carey Clouse** University of Massachusetts  
[clouse@umass.edu](mailto:clouse@umass.edu)

Today, while most food production has effectively become outsourced from the contemporary city, a growing number of future-forward urban agriculture programs highlight an alternative means of food provisioning. These efforts---such as this presentation on the Rome Sustainable Food Project--serve as case studies for the types of productive landscapes that could inform future food security worldwide. While the precedent of a single institutional kitchen garden might seem too specialized to meaningfully contribute to a broader discussion of food security, this privately-funded garden has many ideas and practices that could be applied to other scales and regions. Moreover, the lessons learned from the evolution of the RSFP go beyond providing useful landscape design approaches for other areas: this built example also demonstrates the value of looking at best practices in urban agriculture as a means of preparing for food sovereignty worldwide.

When Alice Waters was invited to overhaul the menus of the American Academy in Rome in 2006, she looked beyond the kitchen to redesign the Academy's gardens as well. Today, the hyper-local edible landscapes that support the Rome Sustainable Food Project have become central to the Academy's identity, in addition to supporting the daily meals served by the institution. With almost a decade of experience and data to share, this precedent suggests a way forward for other institutions and programs interested in bolstering local food provisioning.

This presentation documents the changing shape of the American Academy's gardens in the past decade, and makes a connection between this project and productive urban landscapes in other areas. With a focus on understanding the values, decisions, and investment that has supported the Rome Sustainable Food Project, this project serves as a case study for other institutional landscapes. While the American Academy in Rome is just one of many institutions that has made a commitment to urban agriculture, this exemplary model could provide valuable insight into the design of sustainable landscape planning elsewhere.

# The Geography of Civil Unrest: Designing the Public Realm in the Insurgent Spaces of the City

**Alison B. Hirsch** University of Southern California  
[alisonh@usc.edu](mailto:alisonh@usc.edu)

The 1992 Los Angeles Uprisings/Riots following the Rodney King verdict was a turning point for the city, which became the physical stage for violent expressions of protest. Specific flashpoints in the city, such as the intersection of Florence and Normandie, triggered increasing unrest with a particular urban geography. This more recent urban insurrection in Los Angeles (preceded by the Watts riots of 1965) was not a direct causal response to police brutality but to much wider institutional tyrannies of state, market and media imposing a complex infrastructure of social control.

The paper examines the vacuous spatial relics of the 1992 riots as haunting reminders of how regimes of power have largely persisted amidst this shifting urban demography and how many of the most consequential sites exist today without a palpable trace of the historic events that brought visibility to long-standing inequities. The research questions how design might trigger public conversation about whether and how to recognize and confront difficult pasts in the built environment. It additionally questions how landscape architecture might introduce public space that has meaning as repository of memory, while addressing the pressing needs of today.

The design research was initially inspired by the photographs of Joel Sternfeld, published in a book called *On this Site: Landscape in Memoriam* (1997), which picture places of tragic or traumatic event that exist without palpable trace of these pasts. In other words, the sites imaged – including the initial flashpoint at Florence and Normandie Avenues and the location of the King beating – appear as everyday ordinary spaces yet have extraordinary histories. The paper addresses the spatial inheritance of the riots as sites that reflect both the tyrannies of the “Carceral City” (see Foucault/Mike Davis) and the advancement of collective liberties, as well as features propositions for the future of these sites developed through my design practice, foreground design agency, as well as a graduate design-research studio I conducted at USC.

As the nation’s “first multicultural riots,” the areas they impacted had a complex transcultural character that has continued to change. Therefore, in addition to understanding the conditions of the city that led up to the riots and have since evolved, careful onsite fieldwork was required to integrate ethnographic interpretations into meaningful physical proposals that stimulate new forms of public encounter. Select physical proposals generated from this design-research will serve as illustrative examples and as platforms to provide some concluding statements on the sociospatial implications of recent unrest in cities such as Ferguson and Baltimore.

# The impact of green infrastructure on human health and well-being: A comparison of the Greenway and Urban Park in Blacksburg, Virginia

**Gunwoo Kim** Arizona State University  
[Gunwoo.Kim.1@asu.edu](mailto:Gunwoo.Kim.1@asu.edu)

**Patrick Miller** Virginia Tech  
[pmiller@vt.edu](mailto:pmiller@vt.edu)

The purpose of this study is to determine if human health and well-being benefits can be attributed to green infrastructure projects. Research has shown a positive relationship between nature (trees and greenery) and many aspects of human health and well-being (Kaplan et al., 1998). However, research demonstrating a positive relationship between the broader use of green infrastructure and human health benefits is lacking. The health effects investigated in this study included benefits of green infrastructure projects on air filtration and the relationship of these projects to obesity (BMI), physical activity, psychological benefits, place attachment, and perceived safety. This study identifies and quantifies the health and well-being effects of two different types of green infrastructure: the Huckleberry Trail and Heritage Community Park and Natural Area, both located in Blacksburg, Virginia. The air filtration benefits associated with ozone, sulfur, nitrogen dioxide, carbon monoxide, and particulate matter were analyzed for each type of green infrastructure using the Urban Forest Effects Model (UFORE). To estimate the health benefits from the improvement in air quality, the US Environmental Protection Agency's BenMap was used. A health impact function has four components: an effect estimate from a particular epidemiologic study, the estimated concentration change of pollutants, a baseline incidence rate for the health effect, and the affected population (Wong et al., 2004). To identify possible relationships between different types of green infrastructure and obesity (BMI), physical activity, psychological benefits, place attachment, and safety benefits, a survey of citizen attitudes and perceptions was undertaken.

Preliminary results indicate that the higher visitor frequency and closer distance from home to the green infrastructure results in positive psychological benefits and place attachment. There was a positive relationship between level of physical activity that people engage in and the distance to the green infrastructure site and physical health and place attachment. In terms of gender, females were found to have higher physical health benefits and males reported higher psychological benefits. The higher place attachment was reported for the Huckleberry Trail. The results of the study can be used to justify investment in green infrastructure projects and insights into the types of activities that can be provided by landscape architects and planners who design green infrastructure projects. This study has implications for both policy and practice, in better understanding multiple benefits of green infrastructure in terms of health and well-being and in improving the design of green spaces.

# Recreation Impacts of Disadvantaged Los Angeles Residents on Picnic Areas and River Corridors: Examining Sources of Trash and Water Quality Impacts at Cattle Canyon

**Lee-Anne Milburn** Cal Poly Pomona  
[lsmilburn@cpp.edu](mailto:lsmilburn@cpp.edu)

**Pat Winter** United States Forest Service  
[pwinter@fs.fed.us](mailto:pwinter@fs.fed.us)

Located within the Angeles National Forest (ANF) just north of Los Angeles, the San Gabriel River faces resource management challenges resulting from high levels of dispersed recreational use along the East Fork of the San Gabriel River and the resulting impacts to water quality and habitat. This area is particularly important in light of the number of low income, recent immigrant, and Latino users of the area, who may have limited access to parks and open space as a result of the lack of available public park space in many areas of Los Angeles.

High volumes of garbage are found downstream, and the source has been identified as the Cattle Canyon site. Additional ecological impacts result from the construction of rock dams by visitors to form wading/splash pools. The litter and rock dams have significantly altered the stream's natural function and negatively affected the stream's habitat, which includes the habitat of the Santa Ana Sucker, which is State listed as endangered and federally listed as threatened (WCA, 2014).

It is estimated that during summer months up to 15,000 people per weekend utilize the San Gabriel Canyon for recreation. Data collection occurred over 8 days (9 hours per day) and involved participant observation of activities such as passive and active littering, river play, dam building, and user counts.

The primary goal of the project was to evaluate park user behavior as impacted by an existing educational program, and identify behaviors that impact water quality (such as dam-building and walking and digging in the river). The results of the study indicate that, in spite of the site being the primary source of trash downstream, both passive and active littering are infrequent behaviors. It is posited that the presence of trash in the water course is most likely the result of garbage being left at the end of the day in the river terrace (largely bagged garbage distributed by water, wind, and animals). Generally, litter was the result of non-specific (white or clear) garbage being blown outside of the area claimed by a specific group, and into the public zone between groups, on or adjacent to walkways, or in other unclaimed areas. Dam building was largely performed by male children and adults. Water activities may be resistant to change in part because river play is the primary intent behind user visits to the site. Recommendations are offered which may assist further efforts to improve the visitor experience, modify educational programming, modify site design to address litter and related issues, and protect the watershed. This project suggests that problems related to litter may not be the result of active user behaviors, and as such, may not be impacted by visitor education and interpretation.

# Consuming Wilderness: Our Relationship to the Modern Western Landscape

**Bradford Watson** Montana State University  
[bradford.watson@montana.edu](mailto:bradford.watson@montana.edu)

The National Park Service founding mission (1918) describes its role “to conserve the scenery and the natural and historic objects and the wildlife therein and to provide for the enjoyment of the same in such manner and by such means as will leave them unimpaired for the enjoyment of future generations.” (NPS). Yellowstone National Park attracts more visitors (approximately 4 million this year) than the population of Idaho, Montana and Wyoming combined for this “enjoyment” of nature. The 310 miles of paved roads, over 1,500 buildings and 750 employees allow visitors to consume wilderness with ease.

“Look at it. Once it was a wilderness. Now it's a garden. Aren't you proud?” - Hallie Stoddard, *The Man Who Shot Liberty Valance*.

The Western landscape is not only drawing people to national parks but has created an ideal of inhabiting and controlling the West for those who seek the romance of the frontier, but perhaps not its realities. Be it for a holiday away from city life, or for the permanent retreat from society, people have flocked to this region to experience the “Last Best Place”. Presently towns like Bozeman, MT outpace the national growth (averaging 36% growth per decade since 1870) and campaigns like “Come Home to Montana” encourage people to telecommute to the city from nature. The current Montana “Get Lost” campaign provokes an escape from urbanized life to the wilderness. The enticement of tourists (in Montana presently 10 times the population annually) and new residents is not a recent occurrence. After its reorganization in 1933 the NPS began a strong advertising campaign which generated a series of posters through the WPA that framed the West as something to be consumed. The NPS mission clearly predicted the difficulty facing the West - how to enjoy this place in a way that allows it to persist.

This paper examines the relationship between *wilderness*, land unaltered by humans, *nature*, the highly manipulated landscape, and *perceived wilderness*, land highly managed to allow access to the desired features of wilderness. A series of maps document the infrastructure and impact of human inhabitation on what is perceived to be wilderness as a means of understanding our relationship to the modern western landscape. The maps reveal the concealed interrelated relationships between civilization and wilderness. The findings evidence the commodification, infrastructure and influence our “enjoyment” of nature entails to provoke alternative strategies for mutualistic inhabitation of the West.

# Waste Space or Essential Space? A Report of Systematic Literature Review on Hospital Corridor Design

**Shan Jiang** West Virginia University  
[shan.jiang@mail.wvu.edu](mailto:shan.jiang@mail.wvu.edu)

General hospitals are usually huge in size and extremely sophisticated due to the functional complexity (Latimer et al., 2008). Empirical studies have shown that the institution-like environments of the large hospitals have caused various negative effects on users, such as stress and anxiety, wayfinding difficulties, lack of control, and lack of accessibility to nature (Allison, 2007; Cooper-Marcus, 2007). Since patient-centered care and evidence-based design lead the trend in healthcare designs, the quality of care has been greatly improved in the recent decade (Ulrich, 2000; Ulrich, et al., 2008). However, as the functional circulation spaces that connect users to their immediate outside, hospital corridors are being neglected, and sometimes in the name of efficiency, are often minimized wherever possible (Carthey, 2008).

A systematic literature review was conducted to explore current issues and research gaps regarding hospital corridor design. Combinations of keywords were developed for the literature search in 13 dominant databases in the realm of both health science and built environment planning/design. Fifteen peer-reviewed journal papers were selected for the detailed analysis.

The selected papers were categorized and analyzed according to the target user groups (i.e., general patients, older patients, patients with dementia, and care givers), type of facilities (i.e., patient wards in general hospitals, assisted living facilities, birthing center, and the ICU). Based on the synthesized findings, hospital corridors were argued as essential spaces in healthcare environments. Well-designed hospital corridors may highly correlate with the following healthcare outcomes: (1) legibility of the building and wayfinding; (2) communication between care-givers; (3) perceived quality of care; (4) patients' sense of secure and control; (5) access to nature and other positive distractions.

However, there were surprisingly few studies talked about hospital corridors and the access to nature. Engaging with nature, or simply viewing nature through windows, has been proved therapeutic in various ways (Ulrich, 1984; Verderber, 1986; Vincent, 2009; Jiang, 2015). On the other hand, due to the wayfinding issues and accompanied anxiety, the long, maze-like corridors may eventually discourage users' connection with nature. At this point, several interesting research topics were justified: (1) can (how) window views in hospital corridors facilitate wayfinding? (2) how transparent movement arteries (Jiang, 2015) with abundant natural views and daylight improve accessibilities to nature? Aiming to improve user-experience in hospitals, evidence-based researches on these topics are worth the investigation in the future.

# Urban Soundscapes: The Effects of Auditory and Visual Stimulations on Moods

**Bin Jiang** The University of Hong Kong  
[jiangbin@hku.hk](mailto:jiangbin@hku.hk)

**Wenqi Ji** Shanghai Urban Planning and Design Research Institute

**Matthew Pryor** The University of Hong Kong

**Tian Zhang** Harvard

**William C. Sullivan** University of Illinois

Negative moods can lead to a variety of negative health outcomes. Although we know how a variety of visual elements in a landscape can impact people's moods, we know a great deal less about how sounds in the landscape influence mood. What is the relationship between visual environments and soundscapes, and how do they interact to affect mood in urban cityscapes? To what extent do some typical landscape sounds, such as birds chirping or traffic noise, increase positive or negative feelings?

This research examines the extent to which different sounds in urban landscapes affect people's self-reported mood and explores the relationships between visual elements and sounds on people's moods. We conducted an across-culture, lab-based experimental study in which participants were randomly assigned to watch one of nine videos of three types of urban places (city park, urban street, and office plaza) paired with three types of acoustic environments (nature sound, traffic noise, or no sound). The visual environments of urban places was collected through a video-camera in Chicago city and the sound materials were collected from online sound libraries. We conducted 66 tests in Illinois, USA and 67 tests in Hong Kong SAR, China. Each participant filled out the Multi-dimensional Mood Questionnaire before and after watching and listening to the videos. We measured the impact the visual and sound environments had on changes in participant's moods.

The findings show some common results across USA and HK: soundscapes impact mood more than the visual elements of the urban spaces in consistent and measurable ways. Soundscapes depicting nature evoked pleasant moods for people while traffic sounds evoked unpleasant moods, even when the traffic sounds were paired with calming, natural urban landscapes. We also found some differences between USA and HK tests. Hong Kong participants showed significantly greater appreciation to no sound video than Americans and a low sensitivity to difference of visual environments.

This study produces new knowledge on the effects of different soundscapes on people's mood and has implications for teaching and practice. It is also important to consider difference of cultural background, lifestyle, and place attachment. Most importantly, it suggests that researchers and landscape designers should not ignore sounds and their relationship to visual elements when designing landscapes that promote human health and well-being.



# Incorporating Natural Landforms to Enhance Children's Play Engagement

**David J. Watts** Cal Poly San Luis Obispo  
[djwatts@calpoly.edu](mailto:djwatts@calpoly.edu)

As childhood obesity rates continue to rise it is important to increase physical activity (1). This problem is evident at an early age as studies indicate that pre-school children are less active than they should be, and these play habits have a tendency to continue into later childhood (2). Numerous health and research agencies including the American Society of Pediatrics are prescribing that children engage in active physical play ranging from thirty to sixty minutes per day (3). Additional developmental benefits can be achieved when this time is spent in nature based play environments. Studies have shown that higher cognitive awareness, improved motor skills, and relief from symptoms of ADHD are achieved when children play with nature (4,5,6). For transference of these benefits to occur they need to spend time outside and be physically engaged with the landscape. A unifying factor in these studies is the children being observed are active physical participants with the landscape rather than passive observers.

Little research has been undertaken to understand if natural play elements impact the time of engagement for children on the playground to afford an opportunity for the positive developmental benefits previously identified to occur. One study has identified a timeframe for transference to occur showing that even a minimum twenty-minute walk in a park can mitigate the symptoms of ADHD (7). The purpose of this study is to examine how manipulation of landforms at a preschool playground affects play types and duration of play. A traditionally designed daycare playground at a college campus was provided an opportunity to have the space re-designed permitting the inclusion of new landforms. The primary element in the new design was a mound built in front of a large concrete retaining wall that formed a vertical boundary between the playground and the pre-school building, which was elevated above. The mound provided approximately 5 ½' of grade change, and permitted additional interventions including boulders embedded in the hillside as an alternative physical challenge to ascend the mound. A slide was also integrated into the slope of the mound opposite the boulders.

Children were observed for one-hour intervals playing on the traditional playground, and after construction of the new design children were observed again in a similar manner. Video cameras were staged in locations at the perimeter of the playspace providing the widest field of vision possible, and minimizing their spatial encroachment. Videotapes were analyzed and individual child play times and locations were documented. Preliminary findings indicate that the landform and the subsequent play interventions that were permitted with its inclusion have had an impact on play duration and play diversity. There was an increase of overall users and more child initiated play events observed.

# Urban natural environments, obesity, and health-related quality of life among Hispanic children living in inner-city neighborhoods

**Jun-Hyun Kim** Texas A&M University

[jhkim@arch.tamu.edu](mailto:jhkim@arch.tamu.edu)

**Chanam Lee** Texas A&M University

[chanam@tamu.edu](mailto:chanam@tamu.edu)

**Wonmin Sohn** Texas A&M University

[hiberry@tamu.edu](mailto:hiberry@tamu.edu)

Studies connecting the neighborhood environment with public health concerns have grown rapidly in recent years (Kim et al., 2014, Lee and Moudon, 2004). Numerous previous studies examined the relationship between urban natural environments and mental health conditions (Hartig et al., 2003, Kaplan, 1984, Ulrich et al., 1991). They found that urban greeneries can contribute to public health not only by promoting outdoor activities, but also by helping people relieve daily stresses through their well-documented restorative effects. However, although a substantial body of literature has provided effects of natural environments on well-being, little is known about the role of landscape spatial patterns shaped by urban trees and forests in promoting health-related quality of life (HRQOL), especially among children and adolescents.

This study assessed the association between urban natural environments measured by landscape spatial patterns, obesity and HRQOL among Hispanic children, having lower HRQOL than other population groups from previous studies (Schwimmer et al., 2003, Tyler et al., 2007). Ninety-two 4th and 5th grade students were recruited in Houston, TX. The Pediatric Quality of Life Inventory (PedsQL) was used to capture children's HRQOL (Varni et al., 2005, Varni and Limbers, 2009). For measuring landscape spatial patterns surrounding the participant's home, both a half-mile and a quarter-mile airline radius buffers were generated and analyzed by various landscape indices using FRAGSTATS, a spatial pattern analysis software (McGarigal and Marks, 1995) and Geographic Information Systems.

After controlling for socio-demographic factors, the results revealed that larger and more tree areas were positively correlated with children's HRQOL. In addition, those children living in areas with tree patches further apart from each other showed higher HRQOL. The final regression models also suggested that the total amount of weekend physical activity was positively correlated with children's HRQOL, while negative relationships between children's body mass index (BMI), screening time (e.g. watching TV) during the weekend, and their HRQOL were also found. From the bivariate analyses, children's BMI showed a significantly negative association with their HRQOL.

This research adds to the current multi-disciplinary area of research on environment-health relationships by investigating the roles of urban greeneries and linking their spatial structure with children's HRQOL. This type of multi-disciplinary research on landscape patterns showed the potential to serve as a viable framework with ecological planning considerations for guiding decision-making in the planning and the public health field to promote quality of life of community members.

# EMPIRICAL AND EXPERIENTIAL: Implementing Measure in the Observation of Environmental Phenomena

**Suzanne Mathew** Rhode Island School of Design  
[smathew@risd.edu](mailto:smathew@risd.edu)

The purpose of this study is to develop methods for measuring and visualizing environmental phenomena that are normally described as experiential. This paper will discuss the development of the methods, their efficacy in recording environmental phenomena in an urban and rural setting, and finally, their implementation in the academic studio. Phenomena such as light, sound and wind interact with physical forms in the environment and create volumes of space that are dynamic, and that influence human behavior. Within landscape architecture, this dynamic between environmental phenomena and form is as important to understanding the spaces we design as is our understanding of material and form, and yet it is often treated as an ambiguous spatial quality. Phenomenal effects often appear in renderings to create a sense of atmospheric reality. Digital tools such as Ecotect allow us to map certain environmental phenomena volumetrically, but do not communicate spatial quality or experience.

The empirical observational methods were developed using a Kestrel 4000 Weather Meter, a Garmin Etrex GPS instrument, and ArcGIS, in addition to traditional analog methods of experiential recording. The goal of combining these methodologies was to compare measured environmental gradients---gradual changes in light, temperature, humidity and wind speed, to experiential readings of the environment, in order to create a metric for translating human sensory observations into a volumetric projection. These methods were tested first on two sites: one urban and one rural.

This research is on-going, and the bulk of the work has focused on calibrating methods that work with the sensitivity of the weather instrument and the accuracy of the GPS device. Initial trials showed that the weather instrument's readings fluctuate too often to be used while moving (on a time-based walk of a transect, for instance), and worked better when used for sequential stationary readings (a fixed-point assay). The next stage will occur this fall: students will perform a series of fixed-point site assays and use these readings to create phenomenal site drawings. These drawings will be compared to drawings from the previous year, when experiential drawings were created based on sensory observation by the students, without measured recording.

The ultimate goal of these methods, in the academic setting, will be to help students gain a greater understanding of the relationship between form and phenomenal space, and to develop better methods for visualizing the spatial dimensions of environmental phenomena.

# THE DILEMMA OF THE EDGE: EXPANDING OUR LANGUAGE FOR COASTAL INTERVENTION

**Nancy Vance** Lincoln University  
[nancy.vance@lincoln.ac.nz](mailto:nancy.vance@lincoln.ac.nz)

**Jacky Bowring** Lincoln University  
[jacky.bowring@lincoln.ac.nz](mailto:jacky.bowring@lincoln.ac.nz)

**Mick Abbott** Lincoln University  
[mick.abbott@lincoln.ac.nz](mailto:mick.abbott@lincoln.ac.nz)

Civilization has been attracted to the sea's edge for centuries, where communities have appeared and disappeared over time. We are drawn to this edge between land and sea for ease of trade, transport and nourishment of our physical and spiritual well-being. This attraction faces a significant challenge based on predicted future sea level rise, storm surges and flooding events. With urban populations concentrating in coastal environments, we are increasingly confronted with our susceptibility to intermittent and later permanent water inundation, at a time scale beyond our day-to-day consciousness.

Concurrent with this environmental understanding is a growing awareness of the value of experiencing the sea (ed. Brown & Humberstone, 2015), of thalassic writing and knowing (Steinberg, 2013 cited), and the questioning of how this threshold or liminal space may be occupied into the future. The sea is "a space that, like land, shapes and is shaped by a host of physical and social processes" (Steinberg 1999. P.367) and embracing these processes will be paramount. The coastal edge is made up of continuums through space and time (Ingold, 2015). We seek out a framework for thinking about interventions in this zone, and speculate on other possibilities that transcend the merely physical, exploring other ways of 'owning' and occupying these temporally complex areas.

Significant value has been placed on this edge, there is an economic imperative in the value of land reinforcing, of seawalls and bulkheads to stem coastal erosion and protect assets and infrastructure, under the illusion of permanence – on borrowed time. This paper explores the edges of sea and land, and the ways in which this threshold can be re-conceptualized as a place of exchanges and reciprocity, a place of yielding and retreat, a place of respect and understanding (Peters, 2014). Using a typological model of interventions which echoes the Inside Outside work of Berrizbeitia and Pollak (1999), the potentiality of this threshold space is navigated in design terms, and with a critical frame that places landscape architecture within the range of temporal arcs which relate to the here and now, but more importantly to what is to come. The dilemma of the coastal zone is one which is pressing and demands we would argue the very best of landscape architectural thinking, our stewardship, our understanding of complex systems and our capacity for innovation.

# The effects of participation of community gardening on the development of Sense of Community

**Kyunghee Kim** Virginia Tech Institute and State University

**Yoonku Kwon** Virginia Tech Institute and State University

**Mintai Kim** Virginia Tech Institute and State University

**C. L. Bohannon** Virginia Tech Institute and State University

This paper aims to examine the effects of participation in community gardening on local Sense of Community (SOC). Sense of Community refers to "a feeling that members have of belonging, a feeling that members matter to one another and to the group, and a shared faith that members' needs will be met through their commitment to be together (McMilan & Chavis, 1986)." Therefore, SOC emphasizes citizen's psychological bond with their communities so as to maintain and conserve the society.

Community gardens play a significant role not only in addressing family food issues but more importantly in facilitating social connections among community members (Glover, 2004). In order to investigate how the participation in community gardening affects the local scale of SOC, the 'Local Sense of Community Index' (LSCI) was developed through reviewing the existing research related to the Sense of Community Index since most existing research focused on urban areas. The authors hope that the Sense of Community index representing a combined feeling of belonging, concern for others, and shared faith among members can be a standard of how we measure the roles of community gardens in forming community vitality.

The hypotheses of this study are as follows. First, the participation in community gardening will have a meaningful influence on creating local sense of community. Second, the local SOC will represent differences according to the various categories of the participation, which include the types, degrees, patterns, and duration of the participation. To verify the hypotheses, the survey on both thirty participants who cultivate the products at Hale Y community garden in Blacksburg, VA operated by the YMCA and thirty non-participants of community gardening, who are randomly selected in Blacksburg community, will be conducted and analyzed by t-test, f-test and multiple regression analysis.

This study has significance in proving the benefit of community gardening for the local sense of community quantitatively which was rarely done in previous studies. Based on the results of this study, we will be able to verify the effectiveness of community gardens as a means of community vitality. In addition, this paper establishes the needs, and suggests implications, of establishing policies of community garden to facilitate village communities.

# The psychological effect of Forest School Program on elementary school students

**BumJin Park** Chungnam National University

[bjpark@cnu.ac.kr](mailto:bjpark@cnu.ac.kr)

**Seon A. Kim** Hanbat Arboretum

[djgarden@korea.kr](mailto:djgarden@korea.kr)

As urbanization is deepening and spreading worldwide, the elementary school students in the city have less chance to experience nature.

‘The Forest School Program’ is a regular forest-related activity in the green space in school. The purpose of this study is to clarify the psychological effect of forest school program on elementary school students. Parents are reluctant to let their children play outside as they once did for fear of strangers, traffic or violence (see, for example, Valentine & McKendrick 1997; Herrington & Studtmann 1998). As a result, it is also suggested that children’s play increasingly revolves around organized recreational activities, or is home-centered and focused on computers, video games and television (Valentine & McKendrick 1997). The Forest School Program gains interest as alternative environmental education but its influence on elementary students is not clarified.

The experiment was performed at ‘A’ Elementary School in Daejeon city. Forty-seven students participated in the experimental group of the ‘Forest School Program’ for 8 months. Fifty-three students in the control group didn’t participate in Forest School Program. The experimental group and control group were educated under the same school, same goals and philosophy, except for the activities in forest school.

We surveyed ‘attitude toward forests’, ‘self-esteem’, ‘social skills’ between the experimental group and the control group for 13 times before and after the sessions. Results were collected through non-paired t test using SPSS 20.0. The results have shown that there was significant increase of attitude toward forest, self esteem in the experimental. However, there was no significant change in the control group which didn’t attend forest school program. As for social skills, there was significant increase of ‘diligence’, which is a detailed index of social skills after attending forest school program. Whereas, there was no significant change in the experimental group with regards to ‘independence’, ‘responsibility’ and ‘cooperation’.

Forest School Program can be used for environmental education alternatives. Forest school program can help students to solve problems with classmates and to increase their social skills.

# Children's Perceptions of their Neighborhood's Walking Environment

Chuo Li Mississippi State University

Michael Seymour Mississippi State University

Walking can be a beneficial mode of active transportation for children and mediate the rising obesity rates of recent years. Previous studies suggest that neighborhood attributes have an effect on children's physical activity (De Meester et al. 2014). But questions remain: What are the micro-scale neighborhood design features that would be appealing to the children and thus encourage them to spend more time out in the neighborhood? What do the children like to see when they walk or play outdoors in their neighborhood? Through a questionnaire and Photo-Projective Methods (PPM), this study investigates how children perceive the walking environment in their neighborhoods and how their perceptions impact walking behaviors. This study also examines what micro-scale design features children prefer when they walk in their neighborhood.

This study was conducted in a small town located in the rural American South—the city of Starkville in north-central Mississippi. A total of 86 survey packages were mailed from January to May 2014 to households with children between 8 to 12 years old; 42 survey responses were returned for a 49% response rate. The respondents had a mean age of 9.7, with 57.1% of them girls and 85.7% self-claimed as White. On average, the children had lived in their current neighborhood for 6.3 years. About 76.2% of the respondents reported that they lived in conventional suburban neighborhoods, while the rest lived in traditional neighborhoods. The survey questionnaire solicited self-reported walking/cycling behavior and children's perceptions of their neighborhood's walking environment. For the photo survey, a single-use camera was provided to each of the respondents. The respondents were asked to take 5 to 10 pictures of any features that they find interesting or attractive when they walk along familiar routes that in their neighborhood. Descriptive statistics and classification were used to analyze the survey results. The findings of this study suggest children's perception of the neighborhood walking environments vary by neighborhood types and gender. They also identify the micro-scale design features including vegetation, street layout, and other built elements that are appealing to the children.

# Failed Meadow Installations in the Southeast: Lessons Learned, Theory for Future Success

**Brad E. Davis** University of Georgia  
[bdavis@uga.edu](mailto:bdavis@uga.edu)

Landscape architecture must offer regionally appropriate design solutions nuanced to address the character, context, and public perception of the southeastern landscape. This paper presents failed meadow installations as case studies from the southeast. These include the Atlanta History Center in downtown Atlanta, Georgia, and a recent Hospice Village in Macon, Georgia – both designed to represent natural plant communities but quickly replaced with more conventional plantings.

In recent decades there has been a growing emphasis on planting design that strives for a more naturalistic aesthetic. This phenomenon is easily seen in projects such as the High Line in New York City, the Lurie Garden in downtown Chicago, and recently Tongva Park in Santa Monica, California. These landscapes convey an image of the natural to the public, however the actual composition of plant species typically relies upon a number of non-native yet showy and attractive plants in order to offer an element of more obvious beauty and design intentionality. The word meadow is often used interchangeably to describe a diverse range of planting types and management regimes, some having clear ecological and restorative foci emphasizing use of native plant communities, and others being a more stylized collection of plants with a greater emphasis on aesthetics. Recent books, such as *The Dynamic Landscape*, by Hitchmough and Dunnett, and Tallamy's *Living Landscape*, provide a useful discussion of meadow typologies and their potential value in terms of function, beauty, and legibility. This framework is useful in dissecting unique problems that exist in the Southeastern U.S. where the public may be slower in accepting a naturalistic aesthetic. Factors contributing may include lower population density and vast suburban development where the public must daily interface with what is often described as the jungle like vegetation of the southeast – in contrast with dense urban centers where soft meadow like vegetation offers a higher contrast and visual relief from hard surroundings. Overcoming aesthetic hurdles can be accomplished through more careful plant selection, and availability of key plants. This study suggests the need for a much closer professional network of plant growers and designers. From a more theoretical perspective, southeastern meadow installations may require a higher percentage of plants offering beauty and visual structure, and fewer grasses and a lower overall mature height to serve as a more powerful contrast to what the public perceives as an extremely overgrown and oppressive southeastern natural environment.



# Creating Right Greenway in the High-Density Inner City to Promote Residents' Mental Health and Wellbeing: Evidence from a Mega-city in China

**Weiting Shan** Northeastern University

**Bin Jiang** The University of Hong Kong

Greenway in the high-density inner city is an emerging prototype of public space. Inner-city residents are more likely to reap mental health benefits from nearby landscapes they like and perceive to be safe, restorative, and relaxing—places enabling them to escape the stresses of busy, compact, high-stress urban life (Kuo, Bacaicoa, & Sullivan, 1998; Kuo & Sullivan, 2001; Kweon, Sullivan, & Wiley, 1998; Taylor, Kuo, & Sullivan, 2002). Without a clear understanding of user perceptions, designers lack scientific evidence to create greenways that promote residents' mental health and well-being. To help fill this knowledge gap, researchers conducted a photo-questionnaire regarding greenways in the central urban districts of ShenZhen, a highly dense mega-city in China.

We asked two main research questions: 'To what extent, what citizens' mental responses to the scenes of urban greenways can predict their place preference?' 'To what extent, what environmental characteristics of urban greenways can predict those mental responses?' Three experts selected 60 out of 200 photos that can adequately represent five main greenways in two main residential districts in ShenZhen. 1053 of 1212 recruited residents completed the survey. Each participant answered 24 different questions covering measures of environmental attributes, mental responses, and place preference (7-point Likert Scale questions). Each question was for one randomly assigned photo out of all 60 photos.

We found the place preference is positively associated with four mental responses: *Being Away from Urban Environment*, *Sense of Legibility*, *Relaxation*, and *Being Away from Daily Life*. Significant predictive environmental characteristics for *Being Away from Urban Environment* include *Coherence of landscape elements* (+), *Naturalness* (+), *Tree canopy coverage* (+). Significant predictive characteristics for *Sense of Legibility* include: *View Blocking* (-), *Overall environment quality* (+), and *Naturalness* (-); Significant predictive characteristics for *Relaxation* include: *Coherence of Landscape Elements* (+), *Tree canopy coverage* (+), *View Blocking* (-), *Naturalness* (-); Significant predictive characteristics for *Being Away from the daily life* include: *Naturalness* (+), *Complexity of paving patterns* (-), and *Overall environment quality* (+).

These findings provide clear evidence to direct greenway design in the high-density urban environment. To promote inner-city residents' mental health and wellbeing, designers should focus on specific perceptual pathways and environmental attributes.

*Note: “+” means positive association and “-” means negative association ( $p < .05$ ). Naturalness indicates to what extent a landscape grows spontaneously, without a clear hint of artificial management or pruning (Zheng, Zhang, & Chen, 2011). View Blocking indicates to what extent visitor's vision in situ is obscured by plants or vertical features in the greenway.*

# Healthy Landscapes & Human Health

**William C. Sullivan** University of Illinois at Urbana-Champaign

**Chen-Yen Chang** National Taiwan University

**Bin Jiang** University of Hong Kong

**Dongying Li** University of Illinois at Urbana-Champaign

Although we know that people prefer and benefit from greener, more vegetated landscapes (Bratman, Hamilton, Hahn, et al., 2015; Holtan, Dieterlen, & Sullivan 2014; Tang, Sullivan, & Chang, 2015) we understand little about the impact of ecologically healthy landscapes on human health and wellbeing (Sullivan, Frumkin, Jackson, & Chang, 2014). Biologically diverse, native landscapes contribute a great deal to the overall ecological integrity and resilience of a setting, but to what extent do these aspects of healthy landscapes also promote human health and wellbeing (Chang, Hammitt, Chen, Su, 2008)? What are the human health implications of being exposed to landscapes that support ecological health (Tang, Sullivan, & Chang, 2015)? How might these health benefits be measured?

This pre-conference intensive examines the extent to which landscapes that vary in ecological health impact human health and wellbeing. The landscapes in question range from intensely urban settings to rural farms and forests and encompass a range of ecologically healthy places. We explore these issues via two pathways through which landscapes impact human functioning—by restoring attentional capacity and by reducing stress. The health outcomes we address are measured using a range of traditional and emerging tools in landscape research: participant observation via GPS tracking, physiological measures, functional Magnetic Resonance Imaging (fMRI), and electroencephalogram (EEG). We will explore the advantages and disadvantages of using these tools to measure health related outcomes.

Two of the studies we present allow us to compare results across cultures. In addition to reporting on this recent work, our discussion will identify a number of opportunities for future research.

The panel presentation will begin with participants introducing themselves. Next, six short papers (15 minutes each) will be presented that explore one way in which landscapes that vary in ecological health impact human wellbeing. The session will include open discussion among all participants, allowing us to collectively examine key findings, explore future areas for research, and note new tools for exploring the impact of landscapes on human health. The open discussion will encourage considerable participation to mutually explore the direction and impact of research designed to investigate links between healthy landscapes and healthy people.

# Integrating Agriculture: Case Studies in Contemporary Practice

**Phoebe Lickwar** University of Arkansas  
[plickwar@uark.edu](mailto:plickwar@uark.edu)

Designers play a significant role in the food renaissance of the 21<sup>st</sup> century, reconnecting urban populations to food production through the design of community gardens and rooftop farms. There is a substantial body of literature on the contributions of urban agriculture to food security, sustainability, and urban life. However, little attention has been devoted to the consequences of integrating agriculture in landscapes designed to serve other programmatic and site considerations. Recent work in the profession reveals an emerging area of practice integrating agricultural processes and productivity as strategies for sustainable design.

This paper critically assesses the implementation of agriculture as a sustainable strategy through contemporary case studies. Methods include archival research, site visits, and interviews with designers, clients, and farm managers. The case studies are guided by three central questions: 1) What are the primary motivations for integrating agriculture? 2) How does the integration of agriculture shape design? And 3) What dilemmas or conflicts arise when designers integrate productivity with other project goals such as remediation, conservation, and education?

Winslow Farms Conservancy (1996), designed by Martha Schwartz Partners, integrates productivity with ecological remediation. The 600 acre abandoned property, contaminated by clay quarry operations and used as the town dump, is now the largest certified organic farm east of the Mississippi, providing Saltmeadow Cordgrass for coastal restoration along the eastern seaboard. The project serves as a model of economically viable open space preservation while realizing the productive capacity of derelict land. Green Gulch Farm Zen Center (in construction), a Buddhist practice center in Muir Beach California, integrates crop agriculture with Buddhist practice and ecological restoration. The Long-term Vision and Restoration Plan, created in 2006 by Mithun, proposes a redesign of the property, simultaneously addressing degraded hydrologic systems, conservation goals, and agricultural production. Shenyang Architectural University (2004), designed by Turenscape, integrates rice production within the campus landscape to preserve the former agricultural use of the land and educate an urbanized population about the local agricultural heritage.

The author concludes that site history, client motivations, farm management expertise, market availability, and long-term commitment are important factors influencing ultimate success. Integrated agriculture has the potential to do more than produce food if considered as a set of process based strategies for design.

# Employing Prison Garden Design and Implementation to Enhance Well Being for Incarcerated Women

**Julie Stevens** Iowa State University  
[jstevens@iastate.edu](mailto:jstevens@iastate.edu)

Mass incarceration is a societal problem; prison conditions can be, but are infrequently, addressed by landscape architecture. Furthermore, the female prison population is growing, as are costs associated with offender's mental health treatment and rehabilitation. Environments synonymous with long-term isolation (urban living, submarines, prisons, space colonies) promote high levels of tension, anxiety, depression and anger (Palinkas 2004). Attention Restoration Theory (A.R.T.) developed by Kaplan suggests that contact with nature has positive effects on one's health and well-being particularly when one is experiencing prolonged mental fatigue associated with places such as hospitals and prisons. Additionally, the theory of Supportive Gardens (Cooper Marcus, Sachs) suggests that the views of and the act of gardening can reduce stress.

This presentation articulates the impacts on offenders and staff involved in the establishment, maintenance and use of the Therapeutic Outdoor Classroom designed and built by University students and offender from 2012 to 2015 at the Iowa Correctional Institution for Women in Mitchellville, Iowa. The site design included: visual permeability throughout the garden, circulation within and multiple entrance points around the garden, and plant selection for post-construction soils and extreme microclimate conditions.

This project fulfills several objectives related to design strategy, plant selection, program, and people-environment relationships. The design, created by adapting a strategy developed by Peit Oudolf and Noel Kingsbury, employs prairie species native to Iowa while maintaining sightlines for security. The 1.5-foot plant height limit, partitioned design of the small planting beds, neat lawn borders, and reduced plant palette will serve to simplify maintenance associated with that of a typical 'mixed perennial bed.'

The contemporary planting design is visually appealing and performs many ecosystem services of a natural prairie and serves the needs of the prison community by encouraging offenders to spend time outdoors. Anecdotal evidence suggests that establishing and maintaining this naturalistic garden has fostered the personal well-being of the incarcerated women and staff through pathways such as social cohesion, mutual respect, ability to help others, feeling well, and access to clean air, and choices in seating. The garden also provides valuable vocational and educational opportunities to the women at ICIW for successful reentry.

An IRB approved questionnaire distributed to offenders, officers and staff at ICIW provides qualitative information about gardening, being in and maintaining this newly established garden. This presentation reports on the results of the assessment and provides a draft framework for future work and modifications based the information gathered.

# A Collaborative Heritage Preservation Process for Oil Field Communities

**Dominic L. Fischer** North Dakota State University  
[Dominic.fischer@ndsu.edu](mailto:Dominic.fischer@ndsu.edu)

**Heather Fischer** North Dakota State University  
[Heather.fischer@ndsu.edu](mailto:Heather.fischer@ndsu.edu)

The development trends of rural towns near natural resource extraction often lack a clear planning process and community input. This paper discusses a proposed preservation planning method by which the physical, cultural, and historic content of the town are conserved through the boom, bust and recovery cycle. Furthermore, it shows how critical thresholds can be identified at the state level and guides individual communities to start the heritage preservation process at the local level.

The focus for this study is the Bakken Oil formation, which stretches 200,000 square miles through portions of Montana, North Dakota, Saskatchewan, and Manitoba; its development underlines an arc of physical implications (flaring of thousands of oil and gas wells) that can be seen from space, but little has been done to prepare rural communities for the surge of growth associated with the burgeoning workforce.

This paper illustrates a collaborative process where the growth and development of rural communities can focus on the tangible (quantifiable) built environment (via multi-scale geospatial analysis) while balancing the socio-cultural qualities of agrarian heritage (via local value assessment interviews). The *genius loci* of rural towns should be considered during the city planning process. Cultures of seemingly analogous rural landscapes have varied forms of social and economic activity, cultural activities and the ability to accept external knowledge. The extant cultures serve as resources for mobilizing conditions for planning, appropriate public policy, and heritage preservation to strengthen the physical and cultural landscapes of regions affected by rapid change.

The heritage preservation-planning process was developed as the result of this mixed-method and multi-disciplinary analysis. Richardton, North Dakota serves as the case study to map the findings of the Heritage Planning process. The downward turn in oil prices has hastened the importance of preservation planning following this process to provide rural communities on the threshold of critical disturbance and infrastructure investment with the guidance necessary to utilize new resources for a sustained legacy model of development.

# An exploration of the use of social media for public participation in ecological planning and design process

**Megan Pilla** Rutgers, The State University of New Jersey  
[Megan.Pilla@Rutgers.edu](mailto:Megan.Pilla@Rutgers.edu)

**Frank Gallagher** Rutgers, The State University of New Jersey  
[Gallagher@SEBS.Rutgers.edu](mailto:Gallagher@SEBS.Rutgers.edu)

Democratic participatory process in urban planning and design is a right of the community that should be honored. The National Environmental Policy Act (NEPA) requires public participation in the planning process for all projects that are federally funded, but no such regulations apply to municipal level planning. Translating the intentions of NEPA to the municipal level and incorporating the participatory process into urban landscape planning is necessary for the integration of democratic process with environmental design, which is a functional necessity that Randolph Hester eludes to in *Design for Ecological Democracy* (2006).

This project, which focuses on public open space in Somerville, New Jersey, seeks to integrate ecological design with social needs and participatory process, as inspired by Randolph Hester's theory of ecological democracy. With this goal in mind, the project is a case study in the use of social media as one possible method for translating the participatory process goals of NEPA to the municipal level. A network of social media platforms is being used to create an open forum in which members of the community can directly discuss and provide input to inform design and planning decisions. It is clear that social media is not the only available tool for community participation, but its potential as one option is the focus of this project.

As a means of studying the integration of democratic process with environmental design, this paper will document the Somerville case study, which explores the use of social media as a platform for public participation in the process of urban landscape planning through the dissemination of a unique hashtag, which is linked to an active blog about the project. In an increasingly digital world, a social media forum in which the public is free to engage, communicate, and share creative expression is the essence of participatory culture.

The results of this experiment in public participation will speak to the relationship between social media and public space; they will provide a new understanding of how open space is valued in this particular community; they will produce input that will begin to inform design and planning decisions; and they will attempt to become part of an answer to the professional conundrum of how to integrate the democratic process with environmental design in the digital age.

# How Much Vegetation Density in Green Infrastructure Do People Prefer?

**Pongsakorn Suppakittpaisarn** University of Illinois at Urbana Champaign

**Bin Jiang** The University of Hong Kong

**William C. Sullivan** University of Illinois at Urbana Champaign

Green Infrastructure (GI) refers to the natural spaces in a city that improve urban ecology and bring ecosystem services to citizens (Kondo, Low, Henning, & Branas, 2015). These spaces include rain gardens, bioswales, and green roofs. A few studies have explored people's preferences for and reactions to green infrastructure elements (Nassauer, Wang, & Dayrell, 2009; Sullivan & Lovell, 2006), but they do not explore the factors that influence this preference. One factor that may influence GI preference is vegetation density. Studies show that people prefer natural to urban environments (Velarde, Fry, & Tveit, 2007), but these studies mostly focus on coarse categorizations, such as nature vs. no nature, rather than varying amounts of nature (Sullivan, Frumkin, Jackson, & Chang, 2014).

We do not know how much vegetation density is needed to achieve a moderate or high preference rating. Without this knowledge, we might create landscapes that people do not prefer, and people are unlikely to gain health benefits from places they do not like (Korpela & Hartig, 1996).

This study aims to determine the nature of the relationship between vegetation density in GI photographs and preference. For example, would preference increase steadily as the density increases, or would it decrease when the density gets too high? To answer that, we acquired data from 3 different preference questionnaires where participants rated images in 1-5 scale. The participants are recruited through emails and crowdsourcing website. Using 152 photographs with varying densities of GI including street trees, bioretention, green roofs, etc., we ran curve estimation plots and regression analyses between the vegetation density index and the photographs' average preference scores. The photographs contain different types of GI including street trees, rain gardens, bioswales, green roofs, retention ponds, etc.

More than 1,000 participants rated the images. Our findings suggest that when vegetation density is low (0-25%), an additional increase in vegetation yields a dramatic increase in preference. Preference rates level off but do not decline as density increases to moderate and high levels (25-80%). We found that 45% vegetation density is needed to achieve a moderate preference value of 3. The results of this study are similar to those describing the dose-response relationship between tree canopy density and preference (Jiang, Larsen, Deal, & Sullivan, 2015). These results can be useful to designers seeking to create green infrastructure that people prefer. Limitations such as possible recruitment biases and GI types are discussed.

# Existing built environment elements in outdoor preschool settings and young children's moderate and fast physical activity levels

**Zahra Zamani** Clemson University  
[zzamani@clemson.edu](mailto:zzamani@clemson.edu)

In the past several years children's obesity rates have increased dramatically, with almost 13 million obese adolescent children in the USA. Additionally, children's outdoor free play frequency and duration have diminished although research findings show that outdoor play time is one of the significant predictors of children's physical activity behavior. These problems suggest the significance of outdoor preschool environments as they provide exceptional supervised free play opportunities for young children's physical, social, and cognitive play. However, there is a lack of knowledge on how the existing elements in the outdoor preschool may contribute to young children's activity levels.

Adapting an 'evidence-based design' approach, this study observed children's activity levels in a unique outdoor preschool with three unique playgrounds and 23 types of identified elements. The elements were further categorized into natural loose, natural fixed, manufactured loose, and manufactured fixed. In 12 observation sessions, 36 four-to-five year olds were coded based on the five-level Children's Activity Rating Scale (CARS) that includes: stationary, limb, slow movement, moderate, and fast movements. Cross tabulation was conducted to evaluate the relationship between different categories of elements and moderate and fast movements.

Analyzing the 6801 codes from children's free play behavior, the findings indicated that children were mostly engaged in stationary (28.5%, n=1938), slow movement (26%, n=1765), and then fast movement (20.7%, n=1408) activity levels. The results show that 42.70% (n=307, N=719) of the moderate activity levels were stimulated by manufactured fixed elements, such as the play structures, swings, etc. Compared to other elements, the available manufactured loose elements, such as balls or ropes, stimulated almost half of children's fast movements (51.71%, n=500). Subsequently, natural fixed elements (21.2%) and natural loose elements (19.44%) encouraged children's fast movements. The design challenge in creating outdoor preschools is to include elements and components that provide play opportunities on many levels that support children's physical, social, and cognitive development. Although the results of this study suggest the inclusion of manufactured fixed or loose equipment for stimulating higher levels of physical activity, it is essential to incorporate diverse elements, such as natural features for cognitive or social play behavior opportunities. In sum, the findings are indicative of the importance of incorporating diverse elements (natural or manufactured) in outdoor preschool settings to enhance diverse levels of activity in young children with different abilities and interests.



# Gender differences and physical activity levels: What physical elements in outdoor preschools enhance physical activity levels in female children?

**Zahra Zamani** Clemson University  
[zzamani@clemson.edu](mailto:zzamani@clemson.edu)

Active free play is a form of physical activity in which the child engages in self-initiated spontaneous and voluntary behaviors involving moderate to vigorous activity levels. Reviewed literature suggests that boys are given more freedom to play outdoors frequently, with less supervision, in longer durations, and within a larger spatial range. Additionally, literature suggests the decline of active free play outdoors due to parental safety concerns, changing roles of parents, or reduced number of public play spaces. Recognizing the unique supervised environment of outdoor preschools in which children attend on a regular basis, these reviews highlight the significance of effective design interventions to promote healthy ranges of physical activity, especially in young girls that are less likely to engage in active play behaviors in comparison to boys. Employing an 'evidence-based design' approach, this study compared preschool children's physical activity levels to identify how existing elements in the outdoor preschool may encourage girl's moderate and intense movements. A unique outdoor preschool in North Carolina that incorporated 23 identified elements was purposefully selected. Elements were further categorized into natural loose, natural fixed, manufactured loose, and manufactured fixed. The sample included 36 four-to-five year olds (15 girls and 21 boys) that were observed in 12 recess sessions, and their free play behaviors were coded based on the five-level Children's Activity Rating Scale (CARS): stationary, limb, slow movement, moderate, and fast movements. The analysis involved cross tabulation of data to evaluate how different categories of elements supported moderate and fast movements in young children.

Supporting previous research, girls were more involved in stationary (30.7%) and slow-movement (24.3%) activity levels. Although boys were similarly mainly engaged in stationary (27.1%) and moderate (27%) behaviors, 22.4% of boys' activity levels were fast movements. Manufactured fixed equipment highly encouraged moderate activity levels in girls (51.79%,  $n=159$ ,  $N=307$ ) and boys (42.7%,  $n=307$ ,  $N=719$ ). Further, the occurrence of fast movements was highly associated with interacting with manufactured loose elements (e.g., ropes, balls) in both genders (girls: 62.06%,  $n=175$ ,  $N=282$ ; and boys 51.71%,  $n=500$ ,  $N=967$ ). Recognizing the limitations in this research, Future investigators are recommended to evaluate and compare an even distribution of gender samples for a more accurate comparison. The findings recommends landscape designers to integrate complex manufactured loose and fixed elements in diverse outdoor preschool settings to promote moderate and high physical activity levels. To create outdoor preschools for multi-dimensional development, it is further suggested to integrate and incorporate different natural and manufactured components for young children's physical, cognitive and social free play.

# Different Perspectives on Landscape as a Resource: the Case of the Italian Alpine Region of Trento

**Stefania Staniscia** West Virginia University  
[stefania.staniscia@mail.wvu.edu](mailto:stefania.staniscia@mail.wvu.edu)

**Cristina Mattiucci** University of Trento  
[cristina.mattiucci@unitn.it](mailto:cristina.mattiucci@unitn.it)

In the Italian Alpine regions, where over the last thirty years socio-economic transformations have influenced the traditional productive sectors (agriculture, manufacture, tourism) and settlements (e.g. temporary housing, mountain commuters, etc.) in a peculiar way (Bätzing 2005), the landscape is instead a central and constant element of the territorial capital (Magnaghi 2010, Perlik 2011). It can be considered as a resource or a tangible indicator, as well as a target, by way of the different gazes that interpret and/or use it.

The paper takes into account the results of studies previously carried out by the authors in the Province of Trento (Mattiucci 2011-2014, Staniscia 2011-2014) using them in order to present different perspectives or gazes which on the one hand *produce* and on the other hand *consume* the landscape considered as a resource (Urry 1992, Urry 2002).

The paper aims, first of all, to contribute to the debate about the notion of resource (Mattiucci & Staniscia 2014), presenting the landscape as a paratactic concept that is able to contain the multiple materialities of territorial resources (cultural, economic, agricultural, identity, heritage, natural, etc.) together with the changing social realities and values. And secondly it aims to define the tensions between the different gazes through which the landscape is seen. Insiders and outsiders (Cosgrove 1998) can have very different standpoints and very different values can be attributed to landscape according to those insights. They could be either specialized or local – i.e. researchers, stakeholders – branded or original, plural or individual, institutional or community-based; nevertheless each of them expresses a culture. Considering the landscape both as a product of culture and as a way of building culture, and focusing on the process of reciprocal supporting and construction between landscape and culture, we will discuss how each gaze interprets territorial resources in a different way, and thus differently – and more or less consciously – defines and uses landscape as a resource.

Through the use of the researches carried out, we will show how it is possible to identify a common ground where different and even cross-eyed gazes could find a synthesis. This can happen when developing landscape projects and policies. Indeed, projects and policies can valorize the manifold resources pointed out by the different gazes, providing them with the practical consistency and the tools to improve the same resources, thus the landscape.

# Exploring the relationship between urban trees and residential density within a museum-based urban ecology exhibit

**Jane Buxton** University of Massachusetts- Amherst  
[jane.a.buxton@gmail.com](mailto:jane.a.buxton@gmail.com)

**Robert Ryan** University of Massachusetts- Amherst  
[rlryan@larp.umass.edu](mailto:rlryan@larp.umass.edu)

Sustainable urban design and planning are grounded in understanding complex interconnecting relationships between human and ecological processes. While compulsory education may provide an introduction to this subject, supplementary means are necessary in order to support citizen knowledge, interest and understanding of these complex relationships. Informal learning settings, such as museums, create opportunities for lifelong learning and engagement with the science and issues which underpin urban planning. This study researched this topic as part of development of the City Science exhibit at the EcoTarium Science Museum in Worcester, MA. This unique collaboration between museum exhibit designers, landscape architects, and urban ecologists has developed a model for researching urban planning attitudes within a museum setting.

Sustainable responses to urban development point to the need for higher density neighborhoods coupled with extensive urban tree canopy. However, less research has been conducted with urban residents to ascertain if these urban forms match their preferred setting. This study allowed museum visitors to engage in social science research while learning about the environmental implications of various planning decisions. Building on previous research from an NSF funded urban ecology project in Boston, the current study in Worcester used landscape preference methodology to elicit local residents' preference for neighborhoods, which varied in density and amount of urban tree canopy. In order to reach a more diverse population, the study was conducted on the museum floor as well as two public gatherings in the City of Worcester. In total 130 people from both urban, suburban and rural settings participated in the landscape preference study.

Preliminary study results point to preference for more urban tree canopy to ameliorate the impacts of higher density residential settings. Study participants' responses appeared to be influenced by concerns about privacy, safety and visibility; and environmental benefits (e.g. clean the air and wildlife habitat). Suburban residents differed markedly from their urban counterparts in their preferences for lower density residential neighborhoods. The results of the study provide insights for urban greening projects as well as neighborhood design. In addition, the project also discusses the benefits and challenges of conducting research within a museum setting. Potential further study includes: exploring whether engaging with the various City Science exhibits influences visitors' preferences for urban greening and density; and the relationship between visiting the City Science exhibits and becoming involved in activities that support sustainable cities.

# PERCEPTIONS OF VIDEO WITH ACCOUSTIC SIMULATIONS OF POTENTIAL WIND ENERGY PARKS IN SWITZERLAND: SCENIC VERSUS ACCEPTABILITY JUDGEMENTS, INFORMATION EFFECTS AND ATTITUDES

**ROBERT G. RIBE** University of Oregon  
[rrobe@uoregon.edu](mailto:rrobe@uoregon.edu)

**MADELEINE MANYOKY** Swiss Federal Institute of Technology  
[mmanyoky@alumni.ethz.ch](mailto:mmanyoky@alumni.ethz.ch)

**ULRIKE WISSEN HAYEK** Swiss Federal Institute of Technology  
[wissen@nsl.ethz.ch](mailto:wissen@nsl.ethz.ch)

**ADRIENNE GRÊT-REGAMEY** Swiss Federal Institute of Technology  
[gret@nsl.ethz.ch](mailto:gret@nsl.ethz.ch)

The Swiss have voted to increase renewable energy from all sources including wind parks with large turbines. Such projects encounter opposition in local planning and permitting deliberations often characterized by intensive public participation and referenda (Luyet et al. 2012). The Swiss are concerned about maintaining their cultural landscape and its aesthetic qualities as a source of national identity and tourism. This conundrum is found in many regions and is much studied in field surveys producing a confusion of findings (Karydis 2013). No laboratory studies have focused on ascertaining both aesthetic preference and acceptability perceptions for comparison across wind park locations and designs in relation to people's attitudes and information provided to them about wind parks (Janeckova Molnarova et al. 2012).

Faculty and students at ETH are developing the capacity to produce highly accurate simulations that simultaneously combine visual and acoustic representations of the wind park experiences (Manyoky et al. 2013; Manyoky et al. 2014; Heutschi et al. 2014). Pilot testing of this technology included six simulated wind park experiences that were shown to 90 subjects recruited from the Swiss public. They saw the simulations in a Mobile Visual Acoustic Laboratory transported to different survey sites that replicated simulated experiences with much realism. Subjects rated each experience for scenic preference and also for acceptability both with and without information. They were split by cluster analysis into skeptics and optimists regarding wind energy development based upon questionnaire items about their attitudes and beliefs.

Only extreme bird hazard information significantly affected changes in skeptics' scenic preferences and only in open or mountainous settings; while this information affected their acceptability perceptions across more settings. Optimists' scenic preferences were not affected by any information; while their acceptability perceptions were significantly affected only by high bird hazard information in most settings. Optimists had significantly higher uninformed scenic preferences than skeptics only among smaller wind parks; while this difference was observed among informed scenic preferences across all wind parks. Optimists' acceptability perceptions were significantly higher than skeptics across all wind parks with and without information.

# Multidimensionality of neighborhood satisfaction and use patterns and their associations in urban residential areas

**Sara Hadavi** University of Michigan  
[sahadavi@umich.edu](mailto:sahadavi@umich.edu)

Would greater use of nearby outdoor spaces lead to increased satisfaction with one's neighborhood? Alternatively, it could be argued that the use of the neighborhood resources is enhanced by one's satisfaction with what is available. Perhaps the directionality of the prediction differs if one considers both use patterns and neighborhood satisfaction as complex, multidimensional concepts. The focus of this study, therefore, is to help us understand the directionality between neighborhood satisfaction and use pattern by including a multiplicity of measures for each of these core concepts. Much of the current literature ignores the multidimensionality of these constructs and examine them as single entities. Such a general assessment raises questions of the kinds of neighborhood characteristics that accrue to satisfaction, and the variety of environmental affordances with respect to nearby outdoor settings. By including these multiple dimensions, as well as considering potential barriers to use, this study can offer a more nuanced assessment of ways to enrich the local outdoor environment with the goal of enhancing residents' wellbeing.

This study examines four aspects of neighborhood satisfaction (quality of public space, amount of affordances, amount of green features, and neighborhood comfort), and three forms of use (green/social space use, active engagement, walk to non-nature destinations), and investigates two-way associations between them, as well as the role of perceived barriers to neighborhood use in these associations. A random sample of 434 Chicago residents living in four communities participated in a survey using a five-point rating scale. The three major findings through generalized linear modeling include; 1) multidimensionality of both neighborhood satisfaction and use patterns as important to consider in people-environment studies, 2) the significant roles as predictors *and* as outcomes played by both neighborhood satisfaction and use patterns, with only one factor from each set (satisfaction with quality of public space and green/social space use) showing a two-way relationship, and 3) the main effect of perceived barriers on three of the neighborhood satisfactions, and their *interactive effect* with several of the use pattern and satisfaction factors.

These findings contribute to our understanding of people-environment relationships in urban public spaces and provide insights into how to improve neighborhood satisfaction and frequency of use of outdoor spaces. In practice, such insights can help us avoid ill-allocated financial resources and psychological impacts, resulting in decision-making procedures that may improve both residents' neighborhood satisfaction and likelihood of outdoor space use which may lead to creation or redevelopment of neighborhood spaces that are responsive to users' perception and preferences.

# Impact of Exposure to Green Spaces and Laptop Use on Students' Cognitive Functioning

**Rose Schmillen** University of Illinois at Urbana-Champaign  
[schmill1@illinois.edu](mailto:schmill1@illinois.edu)

**Bin Jiang** University of Hong Kong, China  
[jiangbin19790922@gmail.com](mailto:jiangbin19790922@gmail.com)

**William Sullivan** University of Illinois at Urbana-Champaign  
[wcsulliv@illinois.edu](mailto:wcsulliv@illinois.edu)

Many studies have shown the restorative effects of green spaces, demonstrating that spending time in green spaces or having a window view to nature helps to improve people's ability to pay attention and lower their stress levels (Berman, Jonides, & Kaplan, 2008; S. Kaplan & Berman, 2010; Matsuoka, 2008). In the conditions of these experiments there were no factors to direct the participants' attention elsewhere, whereas in reality there might be many distractions in or around a restorative space. One such distraction is one that people choose for themselves: the use of technology. Today, many people can become absorbed in laptop, cell phone, or tablet screens because of texts, social media, apps, and games. If a person is constantly looking at a screen and not at the surroundings, does it influence the restorative effects of nature? This study investigates how the use of portable devices, specifically laptops, affects attention restoration.

We have collected data using a controlled randomized experimental design with 76 participants. Eligible participants were university students ages 17-28. Six different locations were used for the experiment: three green or 'restorative' spaces, and three barren spaces. The participants were randomly divided between the barren and green spaces, and were then divided into the laptop or no laptop groups. The participants in the laptop group were instructed to use their laptops for activities unrelated to work or school, that is, things they would do while taking a break. The participants' attention was measured before and after they spent fifteen minutes in their assigned conditions.

Preliminary analysis reveals that there is a significant difference in attention scores between the green no laptop group and the other three groups, suggesting that the using a laptop in a restorative space is equivalent to not being in a restorative space at all.

# Territories of Extraction: energy, settlement, hydrology, habitat

**Nicholas Pevzner**

The US is currently on the verge of a radical rebalancing of its energy infrastructure, with the imminent deployment of new energy networks across massive stretches of regional landscape. As the EPA tightens regulations on coal emissions, the government's ambitious alternative energy goals will drastically increase the amount of land leased for solar and wind installations. Overall, the United States will need to transform practically all aspects of its present decaying energy infrastructure in order to bring this new alternative energy production capability into the grid. What effects will the construction of so much new energy production infrastructure, along with all of its associated transmission and storage infrastructure, have on urban territories and their peripheries? How might these massive infrastructural systems affect regional hydrology, habitats, and land use?

Alternative energy technologies are typically presented as self-contained hermetically sealed "technological objects" (Davis, 2013), but in fact can be catalysts of landscape transformation, setting up whole "landscapes of intensification" (Jones, 2014) along transmission and conveyance corridors. This is a landscape typology with roots in the history of anthracite coal canals, oil pipelines, electrical transmission corridors and railroad lines, each of which was deployed to transform the prevailing energy regimes in their region, with the result of cascading land use changes along the line.

The extraction, processing and consumption of energy resources has attracted the attention of policy, economics, and engineering, but these processes have been largely ignored by landscape architecture. While the design and deployment of energy systems operates at the megaregional scale, the act of extraction alters the landscape at both local and regional scales. Rather than merely responding to larger trends, landscape architects can and should be spatializing this debate, critically influencing and grounding the next generation of energy systems and their territories of extraction.

This paper will present speculative design approaches and planning scenarios developed as part of a studio led by the author, investigating new modes of urbanization enabled by transmission armatures along the Pacific Coast. The environmental and urbanistic potential of coupled, synthetic multipurpose landscape corridors will be discussed in the context of the energy transition. By comparing how different technologies of extraction affect their sites' natural and socioeconomic landscapes, and by tracing the interconnected flows of water, agricultural products, industry, labor, and settlement, we can better understand the tradeoffs made in producing energy, as well as how these infrastructural interventions affect communities and the environment.

# Urban Park Design in Iran: Investigation of Factors affecting Users' psychological benefits

**Mehraneh Rayatidamavandi** Iran University of Science and Technology  
[mehrane\\_rayati@iust.ac.ir](mailto:mehrane_rayati@iust.ac.ir)

**Isabel Fernandez** State University of New York  
[icfernand@esf.edu](mailto:icfernand@esf.edu)

Park design in Iran has, since the Qajar dynasty, followed traditional European style. The low quality of the newest parks is such that users prefer ancient geometrical Persian gardens (Faizi et al., 2015). Today those responsible for the design of urban greenspaces lack examples differing from the traditional and thus they are in need of an adequate set of guidelines for how to design for present conditions, users and their needs. This research focuses on the relationship between park design components and users' psychological restoration regarding their preferences and perceptions to increase the quality of parks, diminish vandalism, and increase user agency. People's access to restorative nature is decreasing with urbanization in metropolitan areas. Planners and designers have thus sought to create urban green places that provide opportunities for restoration as part of everyday life (Nordh et al., 2009). By psychological restoration we mean how likely it is that people would be able to rest and recover their ability to focus. A random sample of 100 Tehranian residents was taken by presenting them with images depicting 20 urban parks from around their city. These represented a broad range of park styles, vegetation quantity and type. We asked participants to rate the probability of relaxing and recovering in the parks presented the activities they could imagine performing while in the spaces and how the amenities and appurtenances contributed to high and low levels of restoration. The results were analyzed by grouping into categories: 1. similar activities and 2. by counting and categorizing the individual descriptions of components (frequency of words) contributing to restoration likelihood. Components and activities were classified into five (5) and seven (7) different categories respectively. Findings showed that the categories mentioned most frequently for high levels of restoration were natural categories including: trees, shrubs, flowers and grass; and those with low levels of restoration and recovery, were the absence of nature and negative contextual conditions such as: high rise buildings around the parks, lack of trees, barrier and divisions, and excessive amounts of hardscape. The activities imagined more frequently were relaxing, playing and other physical activities. In conclusion, it can be derived from this research that park users in Tehran prefer natural elements, facilities encouraging physical activities and the application of techniques to soften the surrounding urban structures. They correlated these issues with opportunities for restoration and an increase in their use of parks as social places.



# The Influences of Waterscape Types and Scales on Medical Staff's Psychophysiological Responses

**Man-Li Liao** National Chung Hsing University  
mandy130623@gmail.com

**Wan-Jou Yeh** National Chung Hsing University  
[asxxoy@hotmail.com](mailto:asxxoy@hotmail.com)

**Sheng-Jung Ou** National Chung Hsing University  
[sjou@dragon.nchu.edu.tw](mailto:sjou@dragon.nchu.edu.tw)

**Tsuo-Hung Lan** Taichung Veterans General Hospital  
thlan@ym.edu.tw

Many studies have revealed that high proportion of medical staff is suffering from fatigue and burnout. Fatigue and burnout would contribute to decreasing medical staff members' attention and may result in clinical errors. Natural environment like blue space has already been known for its restorative and recreational benefits. But most studies with the topic of restorative effects of blue spaces focused on students as the subject group. What kind of waterscape has most attention restorative effect for medical staff members has never been examined. This study investigates the influences of different waterscape types (flowing water, waterfalls, fountains, and still water) and scales (large, medium, and small) on medical staff members' psychological responses (restorative feelings) and physiological responses (heart rate and electromyography).

Thirty medical staff members were recruited from the Department of Psychiatry of Taichung Veterans General Hospital in Taiwan. We showed the participants twelve photographs of four waterscape types at three scales for ten seconds each. After seeing each waterscape slide, the participants were asked to report their feelings of restoration by using an adjusted Restorative Component Scale (RCS). Participants' heart rate and electromyography (EMG) were also monitored during seeing the photographs. The collected data was analyzed using two-way repeated measures ANOVA to compare the psychophysiological effects of different waterscape types and scales on medical staff.

The results showed that still water has the greatest effect in attention restoration in comparison with any other waterscape types, and no significant differences were found among large, medium and small scales in still water. The second highest score in attention restoration was waterfalls, followed by flowing water. For these two types, the scores in medium scale were significantly higher than that of large and small scales. The fountain type of waterscape had the lowest scores. We found no difference in heart rate and EMG between any group of waterscape.

The results from current study suggested that the still water, compared to flowing water, waterfalls and fountains, has the highest restorative effect on the busy medical staff. The results will provide a reference for landscape architects and hospital administrators while designing a restorative landscape for psychiatric hospitals.

# Using Google Street View to Examine High School Students' Exposure to Green Space and Their Psychological Well-being

**Dongying Li** University of Illinois at Urbana-Champaign  
[dli13@illinois.edu](mailto:dli13@illinois.edu)

**Marcus Slavenas** University of Illinois at Urbana-Champaign  
[slavenas@illinois.edu](mailto:slavenas@illinois.edu)

**William C. Sullivan** University of Illinois at Urbana-Champaign  
[wcsulliv@illinois.edu](mailto:wcsulliv@illinois.edu)

Adolescents with high levels of stress are at high risk for a wide range of major health and behavioral problems (McNamara, 2000). Traditional intervention programs designed to mitigate adolescent stress are often ineffective or inaccessible (Brymer, Steinberg, Watson, & Pynoos, 2012). One often-overlooked way to help adolescents cope with stress is to increase their day-to-day exposure to green spaces. Evidence demonstrates that exposure to green spaces leads to reduced physiological and psychological levels of stress (Fisak Jr, Richard, & Mann, 2011; Jiang, Li, Larsen, & Sullivan, 2014).

But accurately measuring adolescent's exposure to green spaces can be a significant challenge. The simplest method, drawing a circle on a map with the adolescent's home in the middle of the circle and then calculating the density of the green space within that circle is likely to be inaccurate given how adolescents move in outdoor spaces. Thus, we have a poor understanding of the impact of varying densities and durations of green exposure as a result of individual travel behavior.

To fill this gap, we examined the relationship between high school students' day-to-day exposure to greenness and their stress levels using GPS tracking and Google Street View. We explored the extent to which varying densities of green exposure and varying duration of visits to green spaces were associated with student's stress levels. One hundred and fifty-five high school students from urban areas in central Illinois participated in this study. Participants wore a Garmin Foretrex 301 GPS device for four days. They also took an online version of the Stress Visual Analogue Scale Questionnaire (VAS) and the Profile of Mood States scale (POMS-Y) every day during the study.

Combining GPS trajectory data and Google street view imagery, we extracted one street image for every 15 seconds that students were outdoors. We used machine learning to automatically assess the density of vegetation in each image. After processing all data locations, we calculated the overall density and duration of green exposure.

The result of this study will reveal the extent to which density and duration of green exposure are associated with high school students' psychological well-being. The findings will answer questions such as, what is more restorative, a short-term high intensity exposure or a long-term low-intensity exposure, to green space.

# Finding informality in urban agriculture: From mapping to supporting food equity

**David de la Peña** University of California, Davis  
[dsdelapena@ucdavis.edu](mailto:dsdelapena@ucdavis.edu)

Throughout the US, renewed interest in urban agriculture (UA) has spurred efforts to map existing UA sites and underutilized lots. These efforts have yielded a greater understanding of the landscape of urban food production, and have provided new tools for connecting urban farmers and community-based organizations with available land. In Sacramento, participatory mapping exercises have brought to light a number of sites of food production that have otherwise been neglected from discussions of urban agriculture or food security, even though they are among the most productive sites of food production in the city. This presentation provides an overview of the spatial tools used to evaluate Sacramento's food system; it highlights sites that have been brought into focus through that effort; and it proposes a new focus of mapping exercises: to support social equity by valuing existing UA assets and the informal practices that support them.

Participatory mapping of UA has the potential to mitigate social inequity by engaging with community stakeholders to identify the spatial and land use criteria that are most relevant to disadvantaged populations (e.g. food access, open space, soil quality, pollution exposure, educational programs, employment opportunities). With these criteria in mind, UA maps can move beyond simple assets and opportunities mapping. They can assist policy-makers, residents, food producers, funders, and technical advisors to better identify specific service gaps, guide allocation of resources, measure ecosystem services, and evaluate UA policy implementation over time. An underlying assumption of this approach in Sacramento has been that existing UA sites are a known quantity and are already supported by resources. Therefore the focus has been on planning for new sites. However, the “discovery” of so many existing sites that are under-resourced adds a new area of work—supporting these sites that already have established roots—literally and figuratively—within communities.

In Sacramento, a handful of known actors in urban farming receive the lion's share of visibility and resources. While it is understandable that successful efforts beget more support, this approach does not necessarily match needs with resources and often ignores successes of those growing outside of the spotlight. Neglected in this effort are the food growing activities of minority and immigrant groups. Several large Hmong, Latino, African-American, and Ukrainian gardens exist, but they operate informally and in perpetual states of peril. This presentation describes several of these sites and focuses on one in particular—the International Garden of Many Colors.

An evaluation of the International Garden demonstrates its value while also challenging notions about the purpose, appeal, and benefits of growing food in cities. These understandings have been reached through extensive participant-observation, interviews, and service-learning activities. Among the significant findings of this research is that city-wide UA policies have been adopted in the absence of experience, and that their evolution would best support social equity if they learn from the existing practices of the many informal gardeners and farmers who have been successfully growing food for their families and for profit for many years.

# Attention Restoration Benefits of integrating green space in indoor environments

**Jiajing Chen** University of Illinois at Urbana-Champaign  
[jchen189@illinois.edu](mailto:jchen189@illinois.edu)

**William C. Sullivan** University of Illinois at Urbana-Champaign

**Carol Emmerling-DiNovo** University of Illinois at Urbana-Champaign

Residents of high-density urban areas are especially in need of attention restoration. Prolonged mental fatigue, the outcome of living in a high-stimuli environment constantly focusing on tasks that require attention, causes many health issues. Many studies have shown that spending time in a natural environment helps reduce mental fatigue, but office workers who spend most of working hours inside office buildings have fewer opportunities to go outside or even to view nature from windows.

Although currently there are a lot of research focus on the psychology benefits of indoor plants. The result of these research is mixed and deviated (Bringslimark, T, etc, 2009). Shibara and Suzuki evaluate the plants' influence on attention by conduction task- performing test (2001). Their experiment indicates that potted plants help people recover from attention fatigue during rest time while it somehow distract people during their work time. Other research also find that the placing of indoor plants some how make people's performance decrease when doing a letter identification task (Larsen et al., 1998). Most of these researches focus on potted plants that placed in office. Will the indoor greening in larger scale, such as atrium garden, benefits office worker's attention restoration more effectively than potted plant? This gap in our knowledge creates missed opportunities to focus on the psychological benefits of indoor green spaces while designing them. This study seeks to investigate to what extent indoor green spaces in office environments benefit attention restoration.

60 office workers with no research relevant knowledge participate in the research. Pictures of two conditions of office settings (sample attached), with or without the view of indoor green space, are created by computer. Participants' performance on attention tasks (includes visual reaction time, digit span backwards, color stroop test) will be recorded before and after seeing one set of the scenarios that they are randomly assigned into.

We compare the difference of how participants' attention performance improved after seeing the indoor scenario that they are randomly assigned to (with or with out greening). It will reveal the attention restoration benefit of indoor green space in office settings. We expect to see participants who see the photos of office setting with greening has more significant improvement in performance of attention test. If this is the case, future design should consider more about how to integrate green space inside office building and make these indoor greening more accessible.

# WATER-BASED SPATIAL ANCHOR AS THE SIXTH ELEMENT OF IMAGEABILITY

**Hope Hui Rising** Pennsylvania State University

[hope.rising@psu.edu](mailto:hope.rising@psu.edu)

This study substantiates a water-based spatial anchor as the sixth element of imageability. Water-based elements, as higher-order spatial anchors (Golledge, 1992; Golledge & Stimson, 1997; Osmond, 1963), have been found to emerge before other non-water paths, nodes, districts, and edges in most sketch maps (Lynch, 1960; Milgram, 1976; De Jonge, 1962).

The author sampled 55 sketch maps from eight water cities, coloring their water elements to generate 55 uncolored and 55 colored sketch maps. Each type of map was assigned to a group of two raters (four total raters) who were asked to identify the cities associated with their assigned sketch maps. No rater had visited any of the eight cities. Each was given 10 seconds to review eight city maps before identifying each sketch map. The investigator coded correct and incorrect or unsure identifications as 1 and 0 for uncolored map identifiability (UMI) and colored map identifiability (CMI) as dependent variables. To measure the contribution of water to the identifiability of colored sketch maps, the raters were asked to assess the extent (“very much,” “somewhat,” or “not”) to which each map’s blue features helped them identify a city. The author coded these response categories as 3, 2, or 1, respectively, to produce the variable of water contribution. Water contribution was used to weight CMI to generate another dependent variable, water-based colored map identifiability (WMI). All three dependent variables had acceptable inter-rater reliability (McGraw & Wong, 1996).

This study used cognitive mapping, photovoice, and non-visual protocols to measure three independent variables—waterscape mappability, identifiability, and attachment—as waterscapes’ structural, scenic, and emotional salience. The author included education as another independent variable to measure map exposure while controlling people’s instinctual attachment to water. While education significantly influenced CMI, no significant effect of education was found for UMI. The regression analysis results may indicate water as distinctively different from and more cognitively powerful than the conventional elements of imageability—paths, landmarks, nodes, edges, and districts. The significant effect of education became marginal when accounting for water’s contribution to the identifiability of the colored sketch maps. The regression analysis results suggest that participants’ greater recall salience for blue water elements on cartographic maps and other informational sources may have been attributable to their innate affection toward water rather than to education. The salience of water-based spatial anchors can be expected to contribute to the imageability of water cities.

# School Environments and links to Student's School Performance

**Byoung-Suk Kweon** University of Maryland

**Christopher D. Ellis** University of Maryland

**Junga Lee** Korea University

**Kim Jacobs** University of Maryland

Safe and healthy school environments are critical for children to learn, play and grow. There have been national efforts to build and improve new and existing school environments. The U.S. Environmental Protection Agency developed the first national level school siting guidelines in 2011 mandated by the Congress. Also, the Obama administration announced the first-ever 78 Green Ribbon Schools in 29 States and Washington, DC in 2012. Although research focusing specifically on the academic performance benefits of green spaces is limited, the current research does in fact point to the link between greater amounts of trees on campuses and higher academic performance. Wu et al. (2014) found that students with higher exposure to green space demonstrate higher academic performance than students with lower exposure. Also, students who had greater access to nature and who spent more time outdoors performed better on standardized tests, had higher graduation rates, and were more likely to have plans to attend a four-year college (Matsuoka, 2010). Although we are beginning to develop an understanding of the benefits of trees, few comprehensive studies have been performed that measure the effects of trees on academic achievement. We examine the relationship among green spaces, students' socio-economic factors, and their academic performance by using spatial analysis methods in GIS.

The research study included 219 District of Columbia (DC) public schools. School environment measurements (e.g., land cover), school demographic data (e.g., number of students, student teacher ratio and free lunch enrollment), and school performance data (e.g., DC Comprehensive Student Assessment in math and reading) were collected and georeferenced. A geographic information system (GIS) was used to integrate spatially dependent information regarding student and environmental factors with the land cover data.

We found that students who attended the schools with more trees performed better in math and reading tests after controlling for school size, student teacher ratio and free lunch enrollment. However, not all types of landscapes have the same beneficial properties. Large expanses of land, "featureless landscapes," including large areas of campus lawns and athletic fields have negative effects on academic performance. These results may help to guide landscape architect decisions on the basis on evidence when they plan new and renovate existing schools.

# A Design Framework for Active Aging-Focused Parks

**Eric Bardenhagen** Texas A&M University

**Grant Donald** Silk Tree International

As world populations become increasingly older, more seniors are looking to adapt to lifestyles that will both help them age in their home communities, and enjoy greater freedoms of outdoor activity.

Active aging encourages seniors to be engaged in and to retain connections to community activities throughout their life course. The benefits of increased physical outdoor activity for seniors is well documented and includes, increased flexibility, bone strength, muscular strength, and motor and metabolic fitness. Additionally, cognitive functions, mental health and social adjustment to life changes are bolstered by outdoor physical activity. Indeed, global, national and local health organizations have prioritized efforts to initiate age-friendly policies and have targeted civic services and facilities that seek to provide support for aging adults.

One key dimension of active aging includes the built environment. Specifically, parks and recreation facilities are uniquely suited to provide one avenue of support for both physical and psychosocial needs of seniors. Traditional facilities for active and passive recreation appeal to a broad public, however, in many cases these tend to exclude seniors in subtle ways on the basis of barriers to use that can be either physical or perceived. In either case, the result is widespread underutilization of park facilities by seniors that often begins at the onset of age-related declines in functional status.

This paper will explore, in the context of both the physical and psychosocial needs of seniors, a framework for the design of active aging-focused parks. Set within the context of affording usage by seniors, seven active aging principles for planning and design of parks will be discussed including: 1) supporting rehabilitation, 2) promoting exercise, 3) providing vital connections, 4) enhancing leisure activities, 5) Including appropriate amenities, 6) hosting community interventions, and 7) engaging with music. These principles have been drawn from the literature of the age-related needs of seniors specifically focusing on engagement with outdoor spaces and the physical, cognitive and social benefits these spaces can facilitate.

Using case studies of successful park designs in both the U.S. and China, the resulting framework will outline key elements to meet the needs of seniors in park design and a process for communities to engage in as they seek to increase use and to enhance the ability of these residents to retain their personal autonomy enjoyment of park and recreation facilities as they age.

# Environmental and Personal Correlates of Walking to Park: Exploring distance threshold effects

**Chanam Lee** Texas A&M University

**Young-Jae Kim** North Dakota State University

**Chunkeun Lee** Texas A&M University

**Minjie Xu** Texas A&M University

Parks are important places for physical activities (e.g. Kaczynski et al. 2009). Proximity to park has been one of the most commonly reported environmental factors associated with park visit (e.g. Ries et al. 2009, Schipperijn et al. 2010). However, previous studies assumed a continuous linear relationship between distance-to-park and park visit, and their potential threshold effects or non-linear relations have not been explored. This study examines correlates of walking to park (WTP) utilizing a spline regression model to explore distance threshold effects - whether the odds of WTP change dramatically at certain distance thresholds.

This cross-sectional study used survey and GIS data collected in 2011-2012 from 1,853 adults from nine small towns in three US regions: Washington State, Texas State, and the Northeast (New Hampshire and New York). The study variables included personal, subjective environmental, and objective environmental variables. The spline regression requires meaningful distance thresholds to be considered during the estimation, and two knots (400m and 800m) were determined most appropriate after testing a few literature-derived thresholds. Mixed-effect spline regression models were estimated using Stata, v12.0, to also account for the town-level data clustering.

About 43.5% of the respondents walked to park at least once in the last month. Female adults were less likely to walk to park than males. Older age and longer hours of screen time were negatively associated with the odds of WTP. Distance to park was a significant predictor of WTP in the short ( $\leq 400\text{m}$ ) and the long ( $> 800\text{m}$ ) distance ranges, but not significant in the medium range (400-800m). A 100-meter increase in the distance to park decreased the odds of WTP by 23.1% at the short range ( $p < 0.001$ ) and 7.3% at the long range ( $p = 0.045$ ). Respondents were more likely to WTP if they perceived their neighborhood had attractive sights. Objective-measured street connectivity and the presence of schools or parks in the neighborhood were positively, while fast food restaurants and resource production/extraction land uses were negatively associated with WTP.

Results suggest that while distance is still one of the determinant factors predicting WTP, its role varies across different distance ranges. While it was important in the short ( $\leq 400\text{m}$ ) and the long ( $> 800\text{m}$ ) distance ranges, the physical distance alone within the medium (400-800m) range played little role in promoting or hindering WTP. This suggests that with proper environmental and other supports, parks' catchment/service area can possibly expand up to 800m.

**ACKNOWLEDGEMENT:** This study was supported in part by a grant from the National Institute of Health (1R01HL103478-01A1, PI: Mark Doescher).



# Assessing design principles of urban parks for the purpose of promoting women's satisfaction

**Mehraneh Rayatidamavandi** Iran University of Science and Technology  
[mehrane\\_rayati@iust.ac.ir](mailto:mehrane_rayati@iust.ac.ir)

Parks, as one of the most important urban spaces, play an important role in promoting quality of life and community development (Ghorbani and Teimouri, 1389; 48). Research on urban public spaces has been growing but pays almost no attention to gender differences in the use of these spaces (Franck and Paxon, 1989). Although the quality of park design and inclusion of nature nearby urban areas has been established by many scholars as necessary for human physical and psychological health (Hartig et al., 1991 and Conway, 2000; Annerstedt et al., 2012), park design in Iranian cities remains subjective. Studies show that this ever-increasing inattention to the varied preferences of stakeholders has resulted in a decrease in park quality and a diminished sense of ownership that in turn has exacerbated existing social and infrastructural problems (Daneshpour and Mahmoudpour, 2014). Many studies indicate that in the past, public spaces were occupied mostly by men, and women's activities were allocated to home environment and private spaces (Wilson, 1992). Despite the fundamental changes in gender roles in past 50 years, men and women occupy different social and physical spaces in urban areas, yet this problem exists currently in many countries (Hubbard, 2004; Peterson et al., 1978). It is also argued that urban analysis and theorizing have focused almost exclusively on men and masculinity (Vaiou, 1992). After all, the success or failure of urban planning in creating or remodeling public space should be assessed by measuring both the number of male and female users (Garcia-Ramon et al., 2004). There is little effort to investigate the design guidelines of a desirable park for women. Women are one of the deprived strata of community in urban contexts in Iran. The primary purpose of this gender-based study with a quantitative-analytical approach is to identify design guidelines to enhance women's satisfaction and accordingly their presence. Data collected from scholarly resources and surveys in Saei Park, one of the largest and most important urban parks located in central part of Tehran, was analyzed by SPSS and the factor analysis technique. Results indicate that amongst 13 factors, categorized in three groups including participatory design, design with nature and legibility-accessibility, it was found that participatory design is the most important factor of designing parks for women. This result reveals that, women should be involved in the first steps of design process. Accordingly, participation could promote their sense of belonging to conserve their spaces.

# “We Are the People Living under Fangyan Mountain!” Cultural Landscape and Collective Identity of Yanxia, Zhejiang Province, China

**Wei (Windy) Zhao** University of Utah  
[zhao@arch.utah.edu](mailto:zhao@arch.utah.edu)

Yanxia village is located in the middle of Zhejiang Province, China with a population of about 2,000 people. It lies inside a north-south oriented narrow valley, with Fangyan Mountain, a red-colored sandstone formation, to its west. The east side of Fangyan Mountain is a steep cliff over 200-meters in height, which glows under the morning sun and bathes the entire valley in a warm red tone. This phenomenon is probably the inspiration for naming this settlement “Yanxia,” which literally means “under the rock.” In addition, extensive red-colored sandstone formations dominate the surrounding landscape of Yanxia. This featured landscape has been the focus of folklore and literature, as well as the center for religious, scholarly, and social activities that can be traced back to the ninth century.

This paper first illustrates the historic development of the people-environment relationship centered on Fangyan Mountain through examining folklore, literature, and chronicles. It then analyzes this people-environment relationship through the perspectives of residents in Yanxia who were facing a government-planned relocation to a new settlement outside the valley. This relocation project was part of a national political movement called “Building a New Socialist Countryside.” Drawing upon ethnographic research that adopted the method of photovoice, this paper argues that this people-environment relationship nurtures the cultural landscape of Yanxia and facilitates the construction of the collective identity for people living in Yanxia. Signified through the featured landscape, this collective identity is defined not only through the myth and history revolving around Fangyan Mountain, but also through cultural practices and everyday life carried out by residents of Yanxia. More importantly, in response to the dominant movement of “Building a New Socialist Countryside,” this paper argues that the people-environment *relationship* should be preserved during renovation and “modernization” projects. This relationship not only includes the cultural heritage that grows out of the people-environment relationship, but also the *visual, physical, and financial* connections between people and the environment.

# Healthcare Reform and the Entrepreneurial City

**Laura Marie Barrett** Nimble Ground  
[laura@nimbleground.com](mailto:laura@nimbleground.com)

In the five years since President Barack Obama signed the Affordable Care Act (ACA) into law, millions of previously uninsured Americans have gained access to health care coverage. However, the effect of the legislation on small business operations has been acute. Without the buying power of large corporations, small businesses are faced with costs that are between 8 to 18 percent higher than those paid by big employers for the same health insurance policies, a premium that has been shown to impact business operations. According to a survey conducted by the Society for Human Resource Management, "more than four-in-10 small business owners have delayed hiring due to uncertainty about the effects of the Affordable Care Act" (Rocco, 2013). At a time in which local economies are depending on small business growth as a catalyst for revitalization, the cost of health care is a major factor in decisions to open, grow, or relocate company activities.

Under the ACA, community ratings prevent insurers from varying the cost of health care coverage within a regions based upon age, gender, or health status. The resulting geographic rating, determined by price of service and utilization, tie the fate of neighboring communities' economic and physical wellbeing to one another in a more direct way and to a greater degree than ever before. The purpose of this study is to explore how and why geographic ratings are set and whether adjustments can be made, through improvements to the socio-spatial infrastructure of a community, which offset the potential negative effects of low scores, including loss of business development activity.

The "Prospective Process" methodology developed by Elzbieta Krawczyk and John Ratcliffe for forecasting economic scenarios within urban planning was used to assess the impact that active living and environmental remediation best practices would have upon an urban area undergoing economic revitalization. The study isolates the health impact strategies towards which our nation has invested the most resources and compares the economic consequences of these community scaled interventions with the reinvestment attributed to recent healthcare reform.

# Recreational Community Branding: A Comparative Analysis within Utah's Wasatch Front

**Lynda Draper Smith** Utah State University  
[lyndalouwho@gmail.com](mailto:lyndalouwho@gmail.com)

**Ole Sleipness** Utah State University  
[ole.sleipness@usu.edu](mailto:ole.sleipness@usu.edu)

**David Evans** Utah State University  
[david.evans@usu.edu](mailto:david.evans@usu.edu)

This study documents and evaluates how recreational amenities and their corresponding programming contribute to the brand identity and sense of place in master planned communities along Utah's rapidly urbanizing Wasatch Front.

Utah's population is increasing, with over 75 percent of the State's growth concentrated along the rapidly urbanizing Wasatch Front. Corresponding with its population growth, the region is seeing a rapid expansion of the built environment, most of it on greenfield sites. "Greenfield development is not going away, says industry consultant Jim Heid" ("Planned Communities Are People, Too," n.d.). Many residential master planned communities have been constructed to reflect not only the utilitarian housing needs, but also include opportunities for employment, shopping, services and entertainment. Much of the new growth in the United States is driven by master planned communities; one in six Americans live in one of 230,000 managed master planned communities (Costley, 2006). These communities are designed to enable residents to live, work, and play within close proximity within styled built environments. While the built environment is often branded with a particular identity, these identities also permeate other facets of the community, including their recreation programs and amenities.

This study evaluates how recreational amenities and their corresponding programming contribute to the brand identity and sense of place within master planned communities along Utah's Wasatch Front. Utilizing a comparative case study method, this study characterizes and analyzes the unique contributions that programmed recreational activities and amenities to the branded sense of place within three master planned communities. Employing a review of current literature, content analysis of communities' promotional materials, observations of the physical built environment, and focused interviews with community representatives, this study demonstrates the role recreation plays in creating senses of place that resonate with residents' recreational identities.

Like many regions of the Intermountain West, Utah's Wasatch Front is experiencing rapid population growth spurred by residents seeking a high quality of life in close proximity to recreational amenities. According to Kathleen McCormick, in *Urban Land* magazine, "Urban settings within MPCs have a significant advantage, but the amenities of choice are less about urban environment and more about 'how the place lives.' Buyers want environments that are 'denser, funner, synergistic, and provide more body heat'" ("MPCs Are Bouncing Back, Adding Health and a Sense of Place," n.d.). Focused interviews of residents found this statement to be true. Recreation amenities are a major reason why residents decide to live in a particular MPCs. When designing MPC's recreation amenities are important to include because they provide the necessary brand identity and sense of place that consumer's desire.

# Garden Luminosity

**Molly Hendry** Auburn University  
[mkh0014@auburn.edu](mailto:mkh0014@auburn.edu)

The garden is a poetic composition which focuses on expressing emotions and ideas through a patterned arrangement with distinct style and rhythm. However, in John Dixon Hunt's book, *Greater Perfections*, he states, "But landscape architecture is fractured as a profession [...] it has largely lost touch with whatever conceptual or thoughtful understanding of its activities was available to earlier generations of practitioners, and it has lost touch, too, with gardens not as items to be designed and built but as models or ideas for larger enterprises," (xi). This study is pushing back against the typical formulaic approach towards garden design by analyzing how a deeper conceptual framework can be formed which thoughtfully approaches garden design as a poetic expression. Gardens create intimate connections between places and people by choreographing the garden's structure to frame the layers of ephemeral moments which change throughout the day and year. My research specifically explores how the phenomena of light can be manipulated within the garden to create moments which continually forge a relationship between people and the garden. I will use both structured and abstracted tests to analyze the possibilities for manipulation of light within the design of a garden on a specific site. Structured tests will center around built models which try to capture the form and qualities of the composition. The abstracted tests will use collage as a medium to capture the emotional qualities one might feel while moving through the designed garden. This study is important in order to create a dialogue about the poetics of garden design and the implications that a deeper conceptual and thoughtful approach could have on the future of our profession.

# Using Virtual Reality Techniques to Evaluate Urban Architectural Factors in Relation to Human Stress Levels

**Saleh Kalantari** Washington State University  
[saleh.kalantari@wsu.edu](mailto:saleh.kalantari@wsu.edu)

**Ebrahim Poustinchi** University of Kentucky  
[poustinchi@ucla.edu](mailto:poustinchi@ucla.edu)

Stress associated with urban environments is known to contribute to a variety of negative health outcomes, and the physical geography of cities is a significant factor in creating this stress. Therefore, urban architecture that minimizes environmental stressors and fosters exposure to stress-reducing/restorative features can play a vital role in improving human wellbeing. In recent years a significant amount of architectural research has focused on identifying and modifying stress-associated interior design features in urban buildings, such as healthcare facilities, high-rise offices, and malls. However, the relationship between the exterior features of these buildings and environmental stress has been relatively undermined. The goal of our research is to fill this gap by using Augmented Reality techniques to carefully evaluate urban architectural factors such as building shape, orientation, and visual patterns in relation to human stress levels. The main hypothesis in this research is that designers can reduce general anxiety levels by improving the shape, orientation, and visual patterns of urban buildings. There is undoubtedly a wider range of exterior architectural features that contribute to anxiety level in urban environment such as light, shade, color, spatial sequence, social environment, nature elements, historical and cultural elements, etc.; however, based on patterns discovered in earlier research (Nasar, 1988; Eisen et al., 2008) we have selected shape, orientation, and visual pattern as central candidates for implementing effective anxiety-reducing architectural interventions. We study and document anxiety responses associated with four different architectural shapes (circle, square, triangle, and polygon), three different heights (tall, medium, and low), and five different visual patterns (vertical, horizontal, grid, diagonal, and circular), all within a virtual urban environment. The research participants first complete a written questionnaire, in which they have an opportunity to provide demographic and background data to collect the participants' attitude towards architectural form and content. They are then asked to explore a 3D-generated city using virtual reality headsets. As the participant explores different parts of the virtual city his or her anxiety responses are measured in real time by monitoring blood pressure, respiratory rate, and pulse rate. The results from the pilot study, while limited in their scope, support the overall hypothesis that there is a correlation between stress and architectural form perception, and that this correlation can be evaluated in an Augmented Reality environment. This research contributes to design pedagogy and practice, and it helps to show how continuous parametric urban environment can be used to better reduce anxiety levels in future urban design.

# RESEARCH METHODS



# An fMRI analysis of the graphic design thinking and creativity

**Chun-Yen Chang** National Taiwan University  
[cycmail@ntu.edu.tw](mailto:cycmail@ntu.edu.tw)

**Yu-Ping Tasi** National Taiwan University  
[ypt1204@hotmail.com](mailto:ypt1204@hotmail.com)

For centuries, design has been recognized as a critical pathway toward solving problems. In spite of this recognition, however, we know relatively little about the extent to which specific design processes impact creativity. During the design graphic procedure, designer handles considerable amounts of information that support thinking and decision making (Laseau, 2001). Is one more likely to be creative when simply drawing or when exploring ideas through “graphic thinking”? Being able to think graphically is an important ability for landscape architects and other designers because of promotes divergent cognition, which has been linked to creativity. This study compared neural activities within the brains of 24 individuals engaged in drawing and graphic thinking.

We conducted an experiment in which participants created drawings while their brains were scanned by a functional Magnetic Resonance Imaging machine. While scans were being made, participants copied a landscape graphic on tracing paper. Next, they were asked to create a design that used several geometric patterns that were provided as cues. Finally, participants engaged in graphic thinking by drawing an original design on paper. We compared the neural activity captured in the scans during the copying task and the graphic task.

Results we dramatic. Compared to simply copying an existing plan graphic, when participants engaged in graphic thinking, their left middle frontal gyrus (left prefrontal cortex) became highly activated. This finding is consistent with Geol’s (2014) Frontal Lobe Lateralization Hypothesis and suggests that the left prefrontal cortex of the brain is central to design and creative thinking. Moreover, we compared divergent thinking level which were evaluated by landscape professionals to the brain scans, and verified our hypothesis that individuals who produced drawings judged higher in divergent thinking had significantly more activation in the left prefrontal cortex.

Our findings suggest that creative designs' brain activity differs from copy drawing, and provide the differences of the quality of processing the considerable amounts of design information and the quality of creativity. These findings offer promise of a better understanding of creative design processes and may ultimately suggest activities or exercises that will promote creativity.



# Designing a Neighborhood to Prevent Crime and Increase Physical Activity: A Case Study Among African-American Women in Kansas City, Missouri

**Cydney Jones** Kansas State University  
[cydneyj@ksu.edu](mailto:cydneyj@ksu.edu)

**Hyung Jin Kim** Kansas State University  
[hyungjin@ksu.edu](mailto:hyungjin@ksu.edu)

Obesity levels, related to an increase of physical inactivity, are rapidly rising in the United States (CDC 2009; Office of Disease Prevention and Health Promotion 2008). Reportedly, African-American women have the highest obesity rates when compared to any other demographic in the United States—especially those residing in crime-plagued urban environments (CDC 2009). Yet active living strategies by designers have been least effective amongst this demographic (Day 2006). Researchers report crime-safety perceptions are one of the biggest environmental factors influencing physical activity levels amongst low-income African-American women (Foster and Giles-Corti 2008; Codinhoto et al 2009). Crime prevention through environmental design (CPTED) has been the most common practice towards an intervention of criminal activity in the built environment; however, little practice has addressed both CPTED and physical activity. While first and second generation crime prevention through environmental design (CPTED) are inclusive of addressing both physical and social aspects of the built environment (Cleveland and Seville 2003; Griffin et al. 2008; Dekeseredy et al. 2009), they have yet to effectively address crime-safety needs and its potential relationship with physical activity behaviors of low-income African-American women and their neighborhoods.

Therefore, what built environment changes tailored for this target population—African-American women—are necessary? This study examines 1) what crime safety perceptions of the built environment are affecting low-income African American women's physical activity levels in Kansas City, Missouri and 2) what design solutions these women suggest could help increase their physical activity levels, through improving their perceptions of neighborhood safety. As a place-specific study on a low income neighborhood in Kansas City, Missouri, selected through GIS suitability analyses with literature-based criteria, this study used survey and focus group interview methods to identify the target group's design suggestions. The findings resulted with a connection from research to design solutions—neighborhood and street-level design strategies with CPTED guidelines linking the researched participant's perceptions of crime in their built environment to the effect of crime on their own physical activity.

# TESTING THE RELIABILITY OF SKETCH MAPS FOR MULTI-SITED DESIGN STUDIES

**Hope Hui Rising** Pennsylvania State University  
[hope.rising@psu.edu](mailto:hope.rising@psu.edu)

Sketch maps have been used as a data source for design research since the 1960s. However, these studies (Lynch, 1960; De Jonge, 1962; Appleyard, 1976) have not produced generalizable design principles. This is possibly due to the lack of a reliable multi-sited evaluative framework for sketch maps. The author has proposed three potentially generalizable sketch map assessment rubrics based on the speculated developmental stages of spatial knowledge, from declarative, procedural, hierarchical, topological, and configurational to projective, in the literature of behavioral geography (Golledge & Stimson, 1997; Kuipers, 1978; Montello, 1998). This study postulates these six developmental stages of spatial knowledge as parallels of landmark, path, edge, district, pattern, and diagram. A pattern here denotes a gestalt-like network comprising landmarks, paths, edges, and districts as elements of imageability in Lynch's (1960) terms. A diagram refers to an abstraction of a pattern that is greater than the sum of these elements.

To test the reliability of these rubrics, the author sampled 55 sketch maps from eight cities. Two raters scored 55 sketch maps using the three proposed evaluation rubrics. The author recoded their ratings according to three scoring hypotheses to reflect divergent views in behavioral geography. Scoring scheme A hypothesized that all developmental stages were distinctly different; scoring scheme B posited no distinction among topological, configurational, and projective knowledge types when participants' graphic representational capacities were not significantly different; and scoring scheme C postulated that all spatial knowledge types beyond declarative and procedural components belonged to the overarching category of survey knowledge characterized by the relations of spatial components.

To refine the proposed rubrics, the investigator tested these scores' inter-rater reliability and internal consistency reliability using 0.6 as an acceptable threshold for Cronbach's alpha and an intraclass correlation coefficient (ICC) average measure (McGraw & Wong, 1996). The results of the inter-rater reliability and internal consistency reliability tests validated scoring scheme B, which hypothesized that topological, configurational, and projective knowledge types were not significantly different. Differences in graphic production skill could thus be ignored in this sample. This study demonstrates the feasibility of using behavioral geography and environmental design theories to generate a reliable rubric to evaluate sketch maps. This rubric could potentially enable researchers to quantify the coherence of sketch maps as externalized expressions of spatial knowledge for multi-sited design studies.

# Phenomenological Perspectives as Frameworks for Interdisciplinary Studies of Historic Landscapes Integrating Landscape Architecture, Public History, and Landscape Archeology

**Charles Yuill** West Virginia University  
[cyuill@wvu.edu](mailto:cyuill@wvu.edu)

**Peter Butler** West Virginia University

From a phenomenological perspective, present day landscapes with significant pasts, can be understood by utilizing the artifacts, remains, and ruins of those past landscapes to aid in describing the aspects of everyday life that were driving life in those past landscapes ( those persons inhabiting a historic landscape and the specific choices they made in developing their community landscapes) (Tilley 2010). Landscape documentation can be done integrating on-site observation, oral histories, written accounts and histories, and physical documentation of aspects such as remnants, remains, ruins, and traces. This paper / presentation will describe ongoing work in the central Appalachians that is focused on the 19<sup>th</sup> and early 20<sup>th</sup> industrial landscapes of the region with a particular emphasis on coal mining communities. The overall study region is the Appalachian Coal Heritage Area, a seven million acre federally designated historic area. The historic, and often long abandoned, communities of the region represent a landscape made up of some of the earliest important industrial developments in the United States. The work being undertaken is timely as much of the physical record of this early history has been and continues to be modified and destroyed by subsequent development such as large-scale mountaintop removal mining. This paper will focus on methods for documenting and making sense of the remaining historic record.

Two specific study areas are the focus of our current research – The New River Gorge National River and Gary Hollow, an area that at one time contained the largest underground coal mine in the world. The two areas contain remains of numerous communities that have long since been abandoned, as well as many small towns and communities founded in the early/mid- 19<sup>th</sup> century that are still currently inhabited. Applying a phenomenological approach we are documenting features in the region including: historic buildings, engineering and mining technology features, and historic landscapes (per the HABS, HAER, HALS model) attempting to better understand the development, life-history, and decline / abandonment of those communities from human / community and economic perspectives. We are applying technologies such as airborne Lidar and laser scanning together with written documentation and landscape assessments within the research. The project methodology is providing a framework for understanding and interpreting aspects of life in those communities as expressed in the physical remains of those landscapes that are present today.

# A Mixed Grass Prairie, and Cross Timbers Aesthetic; Principles, Elements, and Materials Defined

**Cheryl Mihalko** Oklahoma State University

[cheryl.mihalko@okstate.edu](mailto:cheryl.mihalko@okstate.edu)

Signature-based landscape design can characterize a place of both nature and culture, and cumulatively provide a sense of recognition that can lead to a human attachment and vested interest in a landscape region. (Woodward 1997) This study develops a more narrowly defined palette of plant-signatures for the mixed grass central prairie and Cross Timbers region that is unique to Oklahoma and a portion of Texas and Kansas.

The study method is first hand observation from natural and disturbed mixed grass prairie landscape and Cross Timbers. Field work and photography document the patterns of landscape plantings in all seasons. The principles of composition are then extracted as distinct and recognizable plant signatures. The isolated design elements are defined and described, and the physical materials and native plant associations are recorded in text and diagrams. The resulting plant signature palette reveals spatial and aesthetic characteristics that have the potential to inspire creative landscape planting design that preserves the regions cultural identity and protects ecological systems in Oklahoma's rapidly growing residential and urban landscapes.

The introduction of aesthetics along with a fundamental ecological understanding of plant functionality and spatiality provides a teachable regional based planting design method that contributes to the understanding of plant communities, cultural, and place. When applied to the education of undergraduate landscape architects, the classroom result has included a strengthening of their independent land ethic, a confidence in finding a starting point for planting design schemes and larger landscape interventions, and an enthusiasm for the application of ecologically based design decisions.

# Scripting in Landscape Assessment: A Vegetation Density Case Study

**Pongsakorn Suppakittpaisarn** University of Illinois at Urbana-Champaign

**Marcus Slavenas** University of Illinois at Urbana-Champaign

**Bin Jiang** The University of Hong Kong

**William C. Sullivan** University of Illinois at Urbana-Champaign

Assessing landscape components in photographs is important in landscape architecture, geography, and other fields. One landscape component that is frequently assessed is density of vegetation. Assessing vegetation density, for instance, can help researchers find out how much vegetation people prefer so that they can encourage landscape designers to build more positive urban environments for people. Others assess vegetation density to find out whether sites meet urban forestry guidelines. Assessing this density from street level photographs, however, can be challenging. We need better ways to rapidly process hundreds or thousands of images to assess vegetation density within a reasonable timeframe.

One promising solution is scripting, a technology that allows us to process large amounts of data in a relatively short time. This tool identifies the shades of color green detected within an eye level landscape photograph and calculates the density of those shades, similar to the NDVI method. However, a scripting tool to assess vegetation density in photographs has not been tested and implemented.

To test a scripted vegetation density tool, we combined data from three different Green Infrastructure preference studies. Using 152 photographs with varying densities of GI, we compared the vegetation index retrieved from Brown Dog, an online scripting service acquired from our collaboration with the National Center of Super-computing Applications (NCSA), to the vegetation index retrieved from a manual method.

Our findings suggest that Brown Dog's scripting service accurately predicts vegetation density ( $\text{Adj } R^2=0.91$ ), and that future research can use this service to speed up the process of identifying different vegetation density in photographs. This study is significant because it tells us we can use this technology to accurately assess eye level vegetation density in a photograph. It will help researchers study other aspects of human responses to greenness, such as attention restoration and stress recovery, in the future.

Future research should implement and test this scripting tool with other landscape photographs, such as photographs from image-sharing websites and Google Street View images. The scripted vegetation density tool is only one of many scripts that Brown Dog offers. Other scripts include changing file formats, obtaining certain images from the webs, and obtaining landscape scenes from Google Street View. Future research can implement and test the accuracy of these scripts, thereby making landscape and geography research easier and more efficient.

# Reasonable Doubt: design experiments for river design in São Paulo

**Brian Davis** Cornell University

The presentation draws from recent advances in experimental geomorphology and landscape architecture to contextualize and discuss emerging methods for river design in São Paulo. Conventional approaches to river design utilize models that assume all essential characteristics of the river can be adequately described and represented. But in São Paulo contemporary technical solutions based on models and precedent are proving both extremely expensive and ineffective (Porto, Braga, Canholi). In recent years advances in landscape architecture (Felson) have suggested that design itself can be a form of research. In the context of São Paulo how can design methods be utilized to produce experiments that account for a plurality of inputs, explore alternative propositions, and allow for results to be evaluated, assessed, and integrated into conventional design operations? This presentation will outline and elaborate on an experimental methodology for designing with urban rivers.

Skepticism toward design research methods related to fluvial landscapes is based in concern for their limitations to predict future effects at the scale of the built project (Paola, et al). However, certain dynamics pertaining to both river morphology and urban design are not defined by scalar relationships. For instance, patterns of erosion, current formation, and pedestrian movement are driven by autogenic and allogenic process mechanisms that are self-similar at multiple scales. To incorporate these insights into conventional protocols of design inquiry requires an expanded logical framework. In this presentation, I will propose an abductive logical framework (Swaffield and Deming) and show how a design experiment is set up using a geomorphology table and digital means to analyze differences over time during trial runs. The results are then integrated into scale drawings to inform the proposal and test its appropriateness.

This presentation will show physical-digital design experiments (not modeling) that inform decision-making processes when developing urban river designs, and proposes that this methodology can develop new insights that overcome some of the limitations of conventional fluvial modeling. This experimental methodology repositions the role of theory in a design process in the absence of modeling, and shifts the focus from reproducible results to transferability and originality. It leverages digital and material techniques for developing original approaches to urban design with river systems. Finally, points toward the emergence of fluvio-urban morphology as a field of inquiry, especially when combined with conventional urban design protocols that emphasize scalar relationships.

# Landscape Visualization in Gaming Environments

**Brent Chamberlain** Kansas State University

[brentchamberlain@ksu.edu](mailto:brentchamberlain@ksu.edu)

**Howard Hahn** Kansas State University

[hhahn@ksu.edu](mailto:hhahn@ksu.edu)

**Natalie Webb** Allworth Design

[nwebb@ksu.edu](mailto:nwebb@ksu.edu)

**Kraig Weber** Norris Design

[kweber@ksu.edu](mailto:kweber@ksu.edu)

**Ryan Albracht** Kansas State University

[ryan12@ksu.edu](mailto:ryan12@ksu.edu)

Creating representations of landscape is an old practice which have invoked a wide variety of mediums (Corner 1992). One of the most recent technological advancements is the use of virtual worlds to represent and communicate landscape (Orland et al. 2001). Of these developments, gaming engines can be coupled with augmented or virtual reality. Gaming engines have been used in the design field for some time (Herwig and Paar 2002), but there has been more of an increase within the last decade (e.g. Johns and Lowe 2006, Paar 2006). The importance of using virtual environments for landscape representation is to better communicate designs or alternatives (Orland et al. 2001, Lynam et al. 2007), future scenarios (Sheppard 2005) and education (Lim et al. 2006).

The purpose of this project is to investigate the use of virtual environments and gaming engines in landscape architecture to identify how gaming engines could be used for communication, education and research. The activities that will be discussed include: 1) story-boarding for landscape environmental education, 2) developing virtual environments to test spatial memory and 3) to develop virtual representations of real places. The implementation of gaming engine coupled with immersion technology (e.g. virtual reality) will also be discussed and demonstrated. The development of hypothetical virtual environments were created through a variety of platforms and methods: GIS, City Engine and from scratch. GIS was used to build a data-driven urban environment, City Engine was used to create a wireframe 3D structure of an urban environment, and development within the gaming engine was done from scratch using built-in and purchased 3D models. Sketchup was also used to build and manipulate 3D models which were then imported into the gaming engine.

While demonstrations of the various projects and associated platforms are part of the outcome, the results also include lessons learned. We found the Unity gaming engine can be used in lieu of existing 3D rendering programs, but the learning curve is higher. Unity has a substantially large user-base, but documentation is geared toward existing users, less so toward non-technical first-time users. This poses challenges for getting started with the user interface, initial setup and optimization. Programming may be necessary for a full experience, but is not needed to provide a full 3D untethered gaming environment. As the user-base of non-technical users grows, so should documentation that will make the freely available software a viable method for promoting future landscape visions.

# Green Infrastructure Impacts on Attention Restoration Measured by Functional Magnetic Resonance Imaging (fMRI)

**William C. Sullivan** University of Illinois at Urbana-Champaign  
[wcsulliv@illinois.edu](mailto:wcsulliv@illinois.edu)

**Xiangrong Jiang** University of Illinois at Urbana-Champaign  
[xjiang19@illinois.edu](mailto:xjiang19@illinois.edu)

**Fatemeh Saeidi-Rizi** University of Illinois at Urbana-Champaign  
[fatemehs@vt.edu](mailto:fatemehs@vt.edu)

Our ability to pay attention is one of our most important and useful resources. It is a requirement for planning, problem solving, negotiating, setting goals, monitoring and regulating behavior, and engaging in effective social interactions. The costs of attentional fatigue (sometimes called mental fatigue) are profound and far-reaching; they include becoming inattentive, withdrawn, irritable, distractible, impulsive, and accident-prone. A growing body of evidence demonstrates that places that gently hold our attention (e.g., a view of green space with trees and grass, being in a park, watching water) allow individuals to recover from mental fatigue (Kaplan & Kaplan, 1989, Berto 2005).

Although it is becoming clear that exposure to green infrastructure has restorative effects on attention, the neural pathways through which these benefits accrue and the associated brain anatomy that underlie their reactions is unclear. We are not sure which modules in the human brain are involved in the attention restoration process. Moreover, we are not sure which types of green infrastructures promote restoration most efficiently. We address these gaps in our knowledge through an experimental research using high-definition functional magnetic resonance imaging (fMRI).

This study involves 60 participants who engage in activities designed to induce mental fatigue. After they are mentally fatigued, participants are randomly assigned to view videos of urban landscapes with or without green infrastructure. Each of the 6-minute videos contains 12, 30-second clips of different urban landscapes. The no-green videos show 12 different urban settings without green infrastructure and the green videos show 12 identical settings in which trees and bioswales have been added via video simulation.

The fMRI is sensitive to the changing values of blood oxygenation levels at varying points in the experiment (Shulman, et al., 2009). When people conduct cognitive demanding task, the brain consumes more oxygen in the areas in charge of cognition. Thus, we examine differences in blood oxygenation levels between the no-green and green infrastructure groups. We expect to see no differences among the participant groups at the initial stage of the experiment and after participants become mentally fatigued. After watching the videos, however, we expect to be able to demonstrate varying levels of recovery from mental fatigue and to be able to identify the specific neural pathways through which restoration occurs. To our knowledge, this is the first fMRI study to examine the impact of green infrastructure on the capacity of people to recover from mental fatigue.



# MAKING TERRAIN: DRONES, PHOTOGRAMMETRY and TRANSLATIONS of SEDIMENT

**Brett Milligan** UC Davis

Surveying is the craft of documenting features of a landscape and translating that information into a topographic plan, a map or other type of descriptive representation. The discipline of landscape architecture has largely outsourced this interpretive skill, relying on others to create their base maps for them. However, technologies with an expanding range of spatial sensing capacities offer designers new opportunities to generate their own landscape surveys. These technologies include consumer grade drones (UAVs), suites of software platforms (photogrammetry, 3D modeling, GIS, others) and real time kinematic (RTK) surveying equipment. Survey methods emerging from these technologies provide the advantages of being relatively inexpensive, combined with being deployable quickly, repeatedly and on demand.

This presentation will illustrate experimental trials deploying these technologies to create a variety of digital terrains from physical landscapes. Research products consisting of high-resolution imagery and three-dimensional models derived from structure-from-motion (SFM) software will be presented. The evolving work flow used to generate these works, and current limitations of the technologies will be discussed.

A wildlife refuge in California's Delta, where dredged sediments are being deposited to manufacture dune habitat for endangered species, will be introduced as a research site for change detection in the landscape through tracking the volumetric deposition of these sediments, their subsequent drift by wind and other forces, and colonization by vegetation. Through identifying patterns and trajectories of landscape change, these surveys are informing current and future research questions for how to best place, sculpt and manage dredged sediments on site.

Findings from this research contribute to discourses on digital landscapes, centering on questions of design craft and the relationship of the digital process and product to the physical/geographic landscapes they model and represent. Most digital design practice works with abstract coordinate systems, or if site-specific, typically works with outsourced and static base data as a prerequisite to design manipulation and fabrication outputs, or utilizes a scaled physical model. Creating terrains with drones operates quite differently, requiring the actor to embed themselves in physical landscapes, performing foundational and ongoing fieldwork as a basis for design investigation. These 1:1 scale practices augment spatio-temporal specificity and foster real-time feedback with the terrain. As embodied process, creativity occurs in the phenomenological translation of the landscape/machine medium. Findings suggest that these technologies effectively confound notions of remote sensing while opening up significant potential for new design research methodologies, cartographic and representational techniques, and aesthetic experiences.

# Synthetic Cartography as Landscape Architectural Research

**Rob Holmes** University of Florida

In recent decades, the desire to understand (and design for) complex socio-environmental geographies has spurred a wide variety of landscape architects to explore various cartographic, visualization, and mapping practices that might be capable of synthesizing the myriad landscape processes, flows, and conditions operating within those geographies. However, these practices remain relatively un-theorized and, consequently, their relationship to scholarly research -- or even whether these practices are capable of constituting scholarly research -- is unclear.

This paper analyzes a set of four recent landscape cartography projects, including work by SCAPE Landscape Architecture (US), P-REX (US), LOLA Landscape Architects (NL), and the Dredge Research Collaborative (US). From these case studies, a definition of one possible form of landscape research emerges. This form, here termed “synthetic cartography”, is defined most fundamentally by its synthetic function: it compiles, distills, and visualizes data collected from disparate datasets, looking for new knowledge in the relationships between previously disconnected or aspatial information. In addition to this primary integrative role, other characteristics are uncovered and explained: it produces spatially explicit knowledge, it is critical, and it is empirical. Unlike the forms of mapping developed by James Corner in work at the University of Pennsylvania and the firm Field Operations, mappings which were intended to function as open-ended agents of creativity in the design process, these synthetic cartographies favor precision and clarity, which makes them better suited to answering specific research questions. These projects are also briefly compared and contrasted with historical antecedents, including work by Ian McHarg, Benton MacKaye, and Charles Manning, and parallel forms of contemporary map-based research in other disciplines, such as geodesign and the nascent hybrid fields of the “spatial humanities”. These comparisons assist in situating synthetic cartography in relationship to schema for understanding landscape architectural research methods, such as the framework delineated in Deming and Swaffield’s *Landscape Architecture Research*.

Ultimately, this definition of synthetic cartography suggests new opportunities for scholarly research to be conducted using a methodology that is specific to the discipline of landscape architecture. This methodology is particularly timely given that landscape architects are increasingly drawn to and asked to participate in transdisciplinary research projects (in academia) and design projects (in professional practice) that deal with complex geographies that are resistant to rapid analysis and plagued by fragmented datasets, such as urbanized coastlines facing sea level rise or infrastructural hydrologies strained by prolonged drought and intense human water demands.

# Identifying the necessity and gaps in data for developing countries to model sea level rise's impact: a case study of Pearl River Delta, China

**Yang Ju** University of California  
[yangju90@berkeley.edu](mailto:yangju90@berkeley.edu)

Sea level rise (SLR) and storm surge will threaten coastal areas around the world (Heberle, Merrill, Keeley, & Lloyd, 2014). Therefore, planning and design should incorporate this issue to adapt to and mitigate the impact. A fundamental step is modeling the potential inundation, which then can be overlaid with other environmental and socioeconomic layers to inform decisions. While such studies have been carried out in developed countries, few are conducted in developing countries, which is a result of developing countries' low level of awareness (Kumar & Geneletti, 2015) and absence of high quality data (e.g. fine resolution ground surface models collected from Lidar). We argue such studies are critical for those countries to avoid potential consequences, especially for those are still under coastal development. To demonstrate this argument, we use China's Pearl River Delta (PRD) as a case study. PRD is one of the three major economic engines in China, and it's expanding to its coast due to limited land resources. We first collected publicly available data, including 100-year storm water level at several tidal gauging stations, 30 m and 90 m resolution ground surface models from satellite measurements such as SRTM and GDEM, road network, and development plans. We then followed the widely used pathway model from NOAA to simulate inundation over the 30 m surface, and identified impacted transportation network and future development projects. Finally, we conducted similar simulation over the 90 m resolution surface to test resolution sensitivity of the results. The results first show that several roads and development projects will be inundated by SLR and storm surge, and several hotspots are identified. Second, the results are sensitive to resolution, meaning that we should use finer resolution data to make more accurate predictions. To conclude, considering the potential consequences, we suggest that SLR and storm surge inundation modeling and adaptation strategies should be included in spatial planning in developing countries. In addition, fine resolution data should be collected and made accessible to research communities to make more accurate predictions. Our approach provides a frame work to understand SLR and storm surge in a broader scale, to raise awareness, to identify hotspots for fine quality data collection. Considering the current constraints in developing countries, a hierarchical modeling approach, which first models at a coarse resolution to achieve an overall understanding and then models at fine resolution for areas of interest, should also be implemented in those countries.

# Developing a Park Quality Index (PQI) as a Tool for Measuring the Impact of Urban Parks on Residential Property Values

**Bungyu Choi** Texas A&M University

[bungyu.choi@tamu.edu](mailto:bungyu.choi@tamu.edu)

**Chanam Lee** Texas A&M University

[chanam@tamu.edu](mailto:chanam@tamu.edu)

The quality of open space or parks is an important factor affecting people's perceptions related to willingness-to-go to the parks and willingness-to-pay for the houses near the parks (Cho, Poudyal, & Roberts, 2008; Kovacs, 2012; Sander & Polasky, 2009). Several studies have established a linkage between the characteristics of parks and property values, but few have systematically examined the specific quality of various park attributes that correspond to higher or lower property values. A few studies, with a limited scope, measured qualities such as cleanness, parking availability, presence of hiking trails, and density of tree canopy (Kovacs, 2012). In response to the shortage of knowledge about the proper measurement tool of park quality and the role of park quality in increasing property values, this study aims to develop a Park Quality Index (PQI) to guide the objective assessments of park quality and facilitate future studies on the roles of various park features in contributing to improving the overall quality of the park.

This study uses previous literature and relevant theories to identify the variables that are important for park quality measurement. A systematic literature review will help extract the park quality factors related to nearby property values. Through a systematic and in-depth review of the pertinent literature, three domains of park quality measures are identified: (a) physical quality, (b) network quality, and (c) operational quality. Physical Quality (PQ) includes park elements (both built and natural elements) and their conditions. Operational Quality (OQ) is related to how the park is operated and maintained by people. Network Quality (NQ) is about connectivity and accessibility of the park. A small set of measurable variables are identified for each domain, and a weighting scheme is proposed to facilitate easy use and interpretation of the results. An inter-rater reliability test will be performed by two trained raters, and be used to assess 288 parks in Austin, Texas; and test-retest reliability will be performed by comparing the ratings of the same raters who completed the instrument. The collected data will be analyzed using hedonic models controlling for structural variables and school districts.

The PQI can serve as an efficient tool for measuring an individual park quality for researchers and practitioners to not only better understand the roles of various individual park features but also identify strategies to design and maintain parks to bring economic and use values to the surrounding communities.

# Do you eat your greens?

**Jeremy Merrill** Texas A&M University

**Bruce Dvorak** Texas A&M University

Green roofs have the potential to perform in a number of ways include: reducing pollution, reducing building energy use, aiding in storm water management (Clark, Adriaens, & Talbot, 2008), providing aesthetic value, and growing food (Whittinghill, Rowe & Cregg, 2013). Using green roofs for food production is increasingly salient due to an increase in public awareness demonstrated by the rising farm to table movement.

This case study will outline an experimental edible planting using a modular green roof system on Langford Building A at Texas A&M University-- summarizing the successes and failures of two growing seasons, and presenting suggestions for future research and expansion. Measured variables include: plant survivorship and productivity, marketable biomass, and economic inputs along with potential return value.

This case study will also report on the educational value of the green roof garden--noting the research and experiential opportunities for students enrolled in a green roof seminar, and the introduction of expanded uses for green roofs to all the landscape architecture students. There is also a greater educational outreach opportunity to more of the university as we seek to market the products of the green roof. This case study will demonstrate the viability of produce sales of an edible green roof as a method for achieving greater economic sustainability of the green roof system, and report on the experience of working with local administration, chefs, food safety, and customers to evaluate the possibility of supplying produce for Azimuth Café, located directly below the green roof.

# SERVICE-LEARNING AND COMMUNITY ENGAGEMENT



# Geodesign as an educational tool

**Barty Warren-Kretzschmar** Utah State University  
[barty.warren@usu.edu](mailto:barty.warren@usu.edu)

**Carlos Licon** Utah State University  
[carlos.licon@usu.edu](mailto:carlos.licon@usu.edu)

The environment decisions that communities make today will leave a lasting imprint on the landscape of the future. Increasingly, communities undertake visioning processes in an attempt to develop sustainable futures for their community based on citizens' values and concerns (e.g. Envision Utah 2007). If visions for our future communities are to meet the needs of the people who are actively living them, then we must involve young people in the process. But can they sufficiently understand the complexity of the issues and the consequences of their decisions on the future community and landscape?

The objective of the study was to investigate the use of Geodesign ([www.geodesignhub.com](http://www.geodesignhub.com)) software to teach environmental planning concepts not only to graduate students, but also to high school students. Geodesign is a collaborative, iterative process used to propose change, which can be rapidly assessed during the planning discussion (Steinitz 2012). Case studies of the use of the Geodesign software show that it successfully supports interdisciplinary groups of experts, planners and university students in developing scenarios for future change, as well as negotiation and decision-making among the participants (Rivero, et al 2015).

This presentation discusses the interim results of an EPA environmental education grant to develop an educational module that can be used at the high school level to increase awareness and knowledge about environmental issues and improve their problem solving and critical-thinking skills. In the first phase of the grant, graduate students tested the suitability of the Geodesign software to be used as a teaching module. In an eight week course module, nine landscape architecture and bioregional planning graduate students at Utah State University analyzed the social, cultural and biophysical issues of Cache County, Utah and prepared a case study with the Geodesign software. In a one-day workshop led by Prof. C. Steinitz local planners, experts and graduate students used the software to develop visions for Cache Valley. The educational experience was evaluated with an online survey and written documentation. The Geodesign software and workshop were assessed with pre- and post- workshop surveys.

The student and workshop evaluations showed the strength of the software to negotiate collaborative solutions to complex environmental problems. However, more time was needed to address the complex issues. Based on these results, the existing case study was simplified for use in the high school setting. The educational module will be tested in a local high school at the beginning of 2016.

# The Structure of Engaging Communities: Structural diversity of design outreach and service

**Jayoung Koo** University of Kentucky

[jayoung.koo@uky.edu](mailto:jayoung.koo@uky.edu)

Design disciplines have a long history of addressing issues, reflecting needs, and visioning the futures of communities and their environments. Such service providers range from public agencies and private offices to non-profit organizations at national to local levels that work with communities to enhance their experiences and physical landscapes. Community engagement and design have become the norm, particularly in higher education institutions in that most have a unit or interested faculty who provide design outreach or services whether in centers, initiatives, programs or through the Cooperative Extension Service. Generally, at least one institution in each state is home to an accredited landscape architecture program and some states offer multiple opportunities. This number far exceeds that of institutions with a formal outlet for community engagement through design. Similarly, since the late 19<sup>th</sup> Century, each state has at least one designated land grant university that serves and provides educational opportunities to communities, particularly in rural areas, through the Cooperative Extension Service with programs supporting production, familial services and youth development as well as community and economic development. Despite this extensive and rooted structure, a limited number of institutions are providing opportunities for communities to benefit from planning or design services that influence the quality of life.

From the community perspective, communities in need of design services are typically limited in resources and are up against complex circumstances particularly in small towns and rural areas that are challenged with a range of intertwined issues ranging from population loss to connectivity. To overcome these challenges, collaborations and partnerships between multiple agencies, stakeholder groups and organizations are essential for community engagement projects involving landscape architecture and other design fields in order to support wider explorations of the potential for the built environment.

To address the potential for community engagement, this study 1) identified 37 land grant universities that have accredited landscape architecture program(s) and Cooperative Extension Service; 2) surveyed and found 4 general organizational structures that exist for community engagement relative to landscape architecture or design outreach and/or service; 3) analyzed the similarities and differences in the level of service ranging from individual to regional that were available to communities; 4) determined the challenges and strengths for landscape architecture programs in relation to the Extension framework that serves individuals to communities; and 5) projected innovative ways to further the practice of engaging communities in design projects in the future such as utilization of web-based applications.



# Pro-Active Recovery Community Structures (PARCS)

**Andrew Fox** North Carolina State University Department

**David Hill** North Carolina State University

Ecologically sensitive coastal environments across the planet are vulnerable to challenges from long-term sea level variations and the more acute forces of powerful storms. When coupled with poor urban development practices, storms produce devastating effects in coastal communities including property damage and loss of life. In North Carolina alone, 22 hurricanes have made direct landfall in since 1950, some reaching category 3 or above on the Saffir-Simpson hurricane wind scale. Four recent hurricanes (Floyd, Fran, Isabel, and Irene) have caused over \$20 billion in damage statewide, and more than 75 deaths. Damages resulting from storms will continue to rise unless new design strategies can produce more resilient landscapes, buildings, and communities.

While researchers in academic institutions have conducted significant studies on coastal issues, the approach is often fragmented into discrete scientific and professional disciplines. This compartmentalization separates the scientific community from designers and often ignores the most critical stakeholders, the coastal residents. Working across professional disciplines and university departments, including Architecture, Landscape Architecture, Civil and Coastal Engineering, Forest Biomaterials, and Marine, Earth and Atmospheric Sciences, the Pro-Active Recovery Community Structures (PARCS) project is transforming this approach by building interdisciplinary teams to address critical issues in natural and anthropogenic development along the North Carolina coastline. PARCS is led by the Coastal Dynamics Design Lab (CDDL), which is housed in the NC State College of Design. The project team has developed partnerships with multiple jurisdictions, institutions, agencies, and practitioners to identify critical storm-related issues that coastal residents face, and to initiate pilot projects that demonstrate resilient and adaptable strategies for community design and construction. The project's primary research question is: How can municipalities in hurricane-prone regions proactively develop damaged and underutilized sites into resilient, multi-use public facilities that are capable of quickly transforming into centers of community recovery during post-disaster response?

The concept of PARCS was initiated to describe a design approach that creates civic amenities and housing for day-to-day use that can rapidly transform into post-disaster staging and recovery sites. This proactive approach to site design and development has the ability to bring about recovery more rapidly. The PARCS projects have included various types of community engagement activities, including in-situ courses. This presentation will describe the team's work with communities and local stakeholders in Dare and Carteret Counties, North Carolina. While initial research and design has been focused on these vulnerable North Carolina locations, the lessons are transferable to coastal communities worldwide.

# Life Cycle of a Service-Learning Project

**Jennifer D. W. Britton** Montana State University

In an effort to foster volunteering and civic engagement, more universities and colleges are integrating collaborative, service-learning educational opportunities into curricula. These tangible learning experiences provide an important link between the campus and local, regional, national and international communities. To these ends, faculty, staff and students from Montana State University's Environmental Horticulture program and Montana State University's department of Facilities, Planning, Design & Construction (FPDC) constructed a demonstration green infrastructure project to protect and maintain local water quality in compliance with the National Pollutant Discharge Elimination Systems (NPDES) program and Municipal Separate Storm Sewer System (MS4's) permit regulations.

In light of the partnership's positive outcome with recognition from Montana's Department of Environmental Quality as a successful demonstration of responsible stormwater management, this case study presentation will illustrate a road map of identifying a campus need and developing of a service-learning project that addresses education in programming, research, applied design, construction documentation, permitting and physical implementation. Information will highlight the variables in an academic setting of engaging multiply stakeholders during the stages of a physical improvement project. A final discussion will examine the projects design/delivery methodology and outcomes through the lens of critical success factor's (CSFs): namely the projects' genesis, pedagogy lessons, life cycle assessment, and post implementation review.

# Student Reflections of Community Engagement in Design Education: Exploration of Social Responsibility and Professional Development

**C.L. Bohannon** Virginia Tech University  
[cbohanno@vt.edu](mailto:cbohanno@vt.edu)

**Terry Clements** Virginia Tech University  
[tclements@vt.edu](mailto:tclements@vt.edu)

With the increased focus of civic and social responsibility in higher education, there has been an expansion in learning opportunities that have transformed learning from merely class-room centered to community-based (Bolan, 2003, Kolb, 1984). This shift in pedagogy is reflected in Landscape Architecture through the integration of design education and community experiences that provide students an opportunity to develop a broader understanding of their current and future roles in society as design professionals. There are a number of studies in the literature that support the impacts of community engagement on student outcomes (Eyler, Giles, Stenson & Gray, 2001, Eyler & Giles, 1999). However, there has been little study on the impact of community engagement on students' social responsibility and professional development in Landscape Architecture. This research focuses on student perspectives of community engagement particularly the impacts of community engagement on student's design education experience in Landscape Architecture.

Participants were selected for this research project from three distinct groups: recent graduates, advanced senior students, and intermediate students who participated in community engagement projects. Each of these groups of students engaged in reflexive inquiry while participating in a community engaged design experience as part of their course of study. This study utilized a two-phased sequential mixed methods research design. The first phase consisted of student responses to the Student Reflections on Community Engagement in Landscape Architecture Survey (SRCELAS), which was developed by the researchers. The second phase consisted of in-depth interviews with students who self selected to participate in the qualitative phase of the study. Descriptive and inferential statistics were used to analyze the quantitative data, and content analysis was used to analyze the qualitative data.

Specific questions explored and discusses include: What are the impacts of community engagement on design students' educational experience? What impact does community engagement have on student's understanding of society, culture, civic responsibility, and ethics? What are the differences and similarities between a traditional design studio experience and a community engaged design experience? The findings provide guidance to educators interested in offering community engagement experiences in their curriculum, as well as specific suggestions for course settings related to integrating community engagement as form of educational praxis. This paper advances the understanding of community engagement learning outcomes through mixed-data reflections from the student perspective. In addition, findings from this research will help faculty across disciplines better articulate learning objectives through the assessment of pedagogical outcomes from community-engaged experiences.

## Together We Design 2: Critical Reflections on Techniques for Transactive Design

**Jeffrey Hou** University of Washington

[jhou@uw.edu](mailto:jhou@uw.edu)

**Randolph Hester** University of California, Berkeley

[rtheater@frontier.com](mailto:rtheater@frontier.com)

**David de la Peña** University of California, Davis

[dsdelapena@ucdavis.edu](mailto:dsdelapena@ucdavis.edu)

**Laura Lawson** Rutgers University

[ljlawson@SEBS.Rutgers.edu](mailto:ljlawson@SEBS.Rutgers.edu)

Following decades of advocacy and experimentation, participatory design has become a common practice in landscape architecture, especially when such practice is legally required in the planning and design process. However, despite the common acceptance, the most effective transactive methods remain elusive (Hester 2014) or remain buried in grassroots stories (Hester 1999) that are inspiring but often hard to replicate. In addition, techniques that are appropriate in one cultural context may not be so in another (Hou 2013). Furthermore, most techniques focus on soliciting community input. They are not concerned with both how the designer “designs” with community users and how community users “design” with the designated professional designer (de la Peña, et al. 2015).

This panel evolved from the previous one at CELA 2015 that brought together accomplished participatory practitioners and scholars to share the techniques they consider most effective in achieving truly collaborative form making with people, or what they call “transactive design.” In contrast to last year’s panel in which selected techniques were presented as a basis for initiating discussion and feedback from the audience, the panel this year will engage in a critical review of more than fifty techniques that were solicited after CELA 2015 for a book project. The submitted techniques range from common approaches of listening, mapping, and simulating, to emerging methods of participatory budgeting, building, and gaming, as well as storytelling and experiencing. The contexts range from engagement of children and youths to that of post-disaster rebuilding, in locations ranging from Guatemala to Ghana, and from Kenya to Korea. However, while the submitted techniques reflect a broad spectrum of contexts and methods, we believe that some important gaps remain which in turn suggests the current deficiency in the theory and practice of transactive, participatory design. For example, few techniques address the power structure inherent in specific political and institutional contexts.

This panel will include four presenters who are experienced practitioners and/or scholars. Presenter 1 will provide an overview of the project, followed by others who will each discuss one particular gap as reflected in the submitted techniques. The audience will be invited to offer additional reflections and make suggestions for additional techniques or case studies to be included in the project. The discussion and outcome of the project are expected to contribute significantly to the theory and practice of participatory design in landscape architecture.

# A Unique Combination of Teaching and Extension Appointments for Faculty: Bridging Community Service and Academic Learning

**Qing Lana Luo** Oklahoma State University

[Qing.Luo@okstate.edu](mailto:Qing.Luo@okstate.edu)

This paper discusses how a special type of combined faculty appointment offers service-learning opportunities. In the discipline of Landscape Architecture, faculty commonly hold either teaching appointments or combined teaching and research appointments. While such appointments are vital for the functioning of academic programs, they can contribute to formal education's detachment from the community. An alternative type of appointment – a Cooperative Extension appointment – moves beyond the limits of program education and expands learning and outcomes into the community. The Cooperative Extension Service is one of the key missions of all land-grant universities in the United States. This national education network provides communities with research-based information on topics related to agriculture, horticulture, natural resources, and community development, among others. For example, at Oklahoma State University, where the author holds a Cooperative Extension appointment, extension forms a key part of a three-part mission (education, research, and extension). The program enables the university to disseminate knowledge to the community.

Focusing on the field of landscape architecture, this paper describes how such extension appointments can work as “bridges” between formal education and community service through service-learning. Because faculty with extension appointments are listed in the Extension Service directory, community members (including public agencies, non-profit organizations, and private parties) who are in need of assistance can seek out the relevant specialists. Faculty can then bring these critical community needs into the classroom for students to examine. Such practical, hands-on experience is crucial in landscape architectural design programs, as real-life projects provide students with more effective learning outcomes.

By using real cases, the paper discusses the significant value of these combined appointments, which open an unobstructed communication channel between community needs and design students' educational needs, and bring more real-world project opportunities into the classroom. Also, the author deliberates the challenges of the split appointments through direct examples.

The paper concludes that combining learning and service into one process through one faculty member's appointment can engage communities and students, and become a valuable service-learning experience for students through careful management.

# In-situ Community Design- Transdisciplinary Storefront as Performative Space

**Ashley Kyber** West Virginia University

**Charlie Yuill** West Virginia University

**Peter Butler** West Virginia University

**Michelle Sloane** West Virginia University

The 'Storefront' concept as an immersive community design and service learning model developed through the work of scholars and practitioners (Angotti, Doble, Horrigan 2011). Seeking to enhance outreach, facilitate a high level of interdisciplinary engagement in meaningful communications with community and provide an authentic service learning experience for students, the model is currently being integrated at West Virginia University through the Office of State, Local & Community Relations aided by the West Virginia Brownfields Assistance Center (WVBAC).

The primary experiment in the model was completed in Spring 2015 with programs in Public Health, Public Administration, Strategic Communications, and Landscape Architecture engaging with residents of Fairmont WV in a multi-faceted process. The space of the storefront grew to become a venue and forum for community engagement, performance, and expression. Landscape architecture faculty and students from three undergraduate studios and a graduate-level studio led the comprehensive effort.

In fulfilling and accomplishing the land grant mission and creating community and university partnerships the engagement was successful. Bonds were established between the university and community and projects and programs will continue through 2016 with the creation of a community garden, continued meetings held by neighborhood action teams, Main Street Fairmont, the BAD Buildings team (WVBAC), and other local groups. A conceptual design for a memorial park will be refined and phased for funding; and a Public Administration course in civic governance will engage with a neighborhood group for the next two years.

As a first step in building community capacity in Fairmont through the storefront model, the community capitals framework (Emery, Fey, Flora 2004) will be applied in reflecting on and analyzing the experience. As the university continues to grow in its development of transformative activities (Sangiorgi 2011) with communities, the storefront model is seen as a centerpiece for channeling the energy and expertise of the academy to underserved locales. Reflections from participants and administrators will be collected as a first step towards developing a knowledge base of the impacts of the model on the variety of disciplines.

# DIY Cartography: Using Creative Placemaking and Historical Perspective to Engage Citizens in Discourse on Community, Culture and Urban Development

**Sara Queen** North Carolina State University  
[sara\\_queen@ncsu.edu](mailto:sara_queen@ncsu.edu)

**Tania Allen** North Carolina State University  
[tania\\_allen@ncsu.edu](mailto:tania_allen@ncsu.edu)

As an ongoing, funded collaboration between the College of Design at NCSU, the Raleigh Urban Design Center, and the City of Raleigh Museum, the goal of this project is to engage citizens in Raleigh's rich and dynamic historical narrative as a means to understand and influence its urban metamorphosis. To achieve this, the DIY (Do It Yourself) Cartography project will curate diverse historical perspectives and facilitate critical and creative placemaking by connecting citizens to a deeper understanding of the city and its urban environments. Conceived as an online archive and series of site specific participatory installations to be developed through a series of cross-disciplinary graduate courses, DIY Cartography will immerse students in constructing a rich understanding of Raleigh's alive and evolving history. Through an iterative and layered process of archival research, synthetic mapping, and participatory survey instrument design, students will contribute to the city's history by expanding the narratives currently marked and memorialized, while simultaneously uncovering and exposing those which are invisible or unrecognized.

At a moment of remarkable growth and redevelopment, this project offers alternative methods to visualize, capture and integrate contemporary and historic voices into a rich discourse on community, culture and urban redevelopment. Since 2001 Raleigh has experienced an unprecedented 43% population growth. As the city continues to expand physically and economically, the need for an inclusive dialog concerning the type of city that Raleigh should be increases dramatically. Many of downtown's adjacent historic neighborhoods are struggling to maintain their identity as rising property values displace longtime community members and new development erases historic urban fabric. This reality makes for a critical moment to reflect and recognize significant urban spaces as we shape the future city.

DIY Cartography will offer a creative placemaking toolkit of alternative dissemination strategies for academics and practitioners; a case study for municipal planning departments to incorporate community perspectives into visioning processes; and a model for diversifying civic engagement. The projected short and long term impacts of DIY Cartography include increased public presence of historical perspective, heightened partnership between the university and local governmental policy makers, expanded awareness of creative placemaking, increased awareness and informed policy decisions concerning "invisible" sites, and strengthened civic engagement. The evaluation plan for measuring and assessing impacts includes pre-instruction and post-instruction student surveys linked to learning outcomes, participant testimonials of community engagement strategies, user experience surveys for the online archive and exhibition, and the Civic Health Index.

# Give and Take: A Social and Material Systems Approach to the Open Community Garden

**Tobiah Horton** Rutgers University

[tobiah.horton@rutgers.edu](mailto:tobiah.horton@rutgers.edu)

Within its neighborhood context the Ujima ungated community garden in Newark, NJ exhibits a social and material porosity of give and take. A strong community use of the open space and the potential to increase collective work usage of the site led to a collaboration between the non-profit garden manager, It Takes a Village, Inc and the Design/Build Praxis Studio of Rutgers Landscape Architecture Department. This paper will use the case study of the Ujima Garden to investigate the relationships between social change through work/learning programs that are built upon existing social activities and spatial uses. The social use of the garden, consisting of gathering, playing, memorializing and celebrating creates a sense of community ownership of the unfenced space. The partners identified this openness as a key foundation for expanding the garden's usage to collective work. The ongoing collaborative programs lead to planned and opportunistic engagements by neighborhood youth, local parishioners, community activists, community service programs and alternative incarceration programs; all groups that may not typically be involved in gated community garden work.

The openness of the garden/park to the neighborhood will be discussed as a broad invitation to neighbors to participate, learn and grow with the work undertaken in the garden. From the social structure of the garden's place in the community, inclusive activities introduced material practices to complement and augment the learning, engagement and productive potential. In the studio the site was considered a place of transformation. Seen through the material lenses of water, soils, food, building materials and social life, the Landscape Architecture students worked with community members to analyze conditions, and then design and build responsive solutions. Inspired by the openness, service and learning in the social use of the garden, the material research and design sought to encourage the transformation of materials through reuse, rehabilitation, recovery and addition of value. Rainwater, leaf litter/food scraps and demolition materials were changed from wasted resources to valuable garden commodities. The methods include an analysis of the garden as a system of social and material input, transformation and output. The case study will be situated within research on community gardens and the design/build process as mutually reinforcing loops of social and physical transformation.



# Turning to a Landscape of Citizenship: the critical effects of introducing landscape architecture to the Cleveland Urban Design Collaborative

**William T. Willoughby** Kent State University  
[wwilloug@kent.edu](mailto:wwilloug@kent.edu)

**Charles Frederick** Kent State University  
[cfrederi@kent.edu](mailto:cfrederi@kent.edu)

For fifteen years, the Cleveland Urban Design Collaborative (CUDC) has been a practice-based educational model and location where solving civic problems urbanistically or landscape-wise has persisted through periods of collaboration to times of dilemma and debate. Recently, the CUDC's mission of practicing and educating urban designers has addressed the challenges of shrinking and legacy cities of Northeast Ohio through landscape-based solutions. Yet students and practitioners at the CUDC have had difficulty addressing these problems through landscape architecture due in large part to a lack of resident expertise.

However, with the introduction of a graduate landscape architecture program last year, communities calling on the CUDC now have an new outlet for turning landscape-based problems, deemed relevant for students, into service-learning opportunities for exploring landscape architecture. With this change, the CUDC has expanded its mission through a stronger turn toward landscape. Reclamation of historic parks, consolidating vacant residential lots into something wholesome for the remaining community, addressing storm water management with green infrastructure, freshwater issues facing lakefronts, urban agriculture, and transportation alternatives like biking and paddling are among the contributions landscape architecture has brought to the CUDC.

Strategies for citizen engagement in the landscape architecture program and the CUDC span two poles: at one end community service and civic activism at the other. And yet despite their divergence, the differences between service and activism are key to the CUDC's model of civic engagement. Community partnerships play out in design studios, study tours, workshops, conversations with future partners, charrettes, and student-led practice opportunities—and altogether mean to make students into active citizens in their region. This essay outlines the intellectual, social, and curricular changes taking place after a year of landscape architecture education at the CUDC. The program has tackled projects with a strong and direct bearing on community engagement and citizenship both in and beyond the design studio.

Inquiring into many facets of the CUDC's mission and describing its current state-of-art, this paper journalistically dissects, deconstructs, and critically assays the projects and changes within the CUDC relative to landscape architecture. The multidisciplinary combination of expertise in architectural education, urban design practice, and landscape architecture is put forward as a debatable model for design education, university-community engagement, and the participation of design professionals and experts from the region and around the nation. The essay and visual presentation shares case studies developed by citizen-student designers that combine education, landscape architecture, and community engagement.

# Rural Interdisciplinary Service-Learning Projects: Frameworks for Engagement within Regional Rural Development Centers

**Ole Sleipness** Utah State University

[ole.sleipness@usu.edu](mailto:ole.sleipness@usu.edu)

**Kathleen Ryan** Washington State University

[karyan@wsu.edu](mailto:karyan@wsu.edu)

**Robert Krikac** Washington State University

[rkrikac@wsu.edu](mailto:rkrikac@wsu.edu)

**Susie Gomez** Utah State University

[becauseican42@gmail.com](mailto:becauseican42@gmail.com)

This study evaluates university design programs' involvement in the four regionally located USDA-funded Rural Community Development Centers and recommends ways in which the centers can provide an organizing framework for interdisciplinary service-learning endeavors.

In recent decades, design programs have engaged communities' tangible needs through service-learning, civic engagement, and participatory action research. These approaches offer experiential learning opportunities for students and provide services to underserved communities (Lee, 2008). Recognizing these benefits, academic programs employ these models of engagement in their pedagogical approaches at the project, course, or program levels.

In the current era of urbanization, rural communities and their landscapes represent an array of large-scale design challenges. While landscape architecture maintains a body of work in the planning, design, and management of large-scale and rural landscapes, allied design disciplines have been reticent to engage in rural projects within the university studio setting to a comparable degree.

Funded by the USDA, the four regional Rural Community Development Centers focus on research and outreach; their foci are influenced by unique rural dilemmas in the western, southern, north central, and northeast regions. While these foci often engage the built environment, design disciplines at each center's member schools are often underrepresented within regional development center initiatives. This study identifies ways in which design programs can increase their engagement with rural issues through collaboration with regional rural development centers.

Using a grounded theory approach, a content analysis of publications for each of the four centers revealed their regional foci, as well as levels of involvement of design disciplines within each center's member institutions. This archival data is juxtaposed with focused interview responses from center board members and staff in order to identify opportunities for design engagement.

The built environment often plays a dominant role within the rural dilemmas engaged by the centers. While design disciplines within member institutions possess valuable creative expertise and visualization skills, the four regional centers do not take full advantage of these skills.

Previous research indicates the persistence of challenges to implementing truly interdisciplinary collaborative programs that focus on rural design engagement. The four regional centers can provide an organizing framework for nationally recognized and funded research and outreach priorities. This study identifies opportunities for the design disciplines (specifically landscape architecture, interior design, and architecture) to contribute to these priorities within an established engagement framework, and recommends strategies for engaging in interdisciplinary and collaborative service-learning projects.

# The Community Design Team: Pedagogy of Practice and Community Service

**David Evans** Utah State University

[david.evans@usu.edu](mailto:david.evans@usu.edu)

**David Anderson** Utah State University

[david.anderson@usu.edu](mailto:david.anderson@usu.edu)

The Community Design Team is an LAEP Extension program that focuses on service-learning and community engagement. The CDT is not a part of the curriculum and relies on student volunteers. In the spirit of our land grant mission, the CDT prepares communication and fundraising tools that establish a design vision, support client objectives and lead to successful grant and fundraising activities. Our work typically addresses underfunded projects, and sets the stage for professional consulting. The cost-recovery fees collected from the CDT supports the student chapter of the ASLA.

Led by a faculty member, a student program manager, a student job captain, and volunteer student teams of from 3 to 6 students, a learning environment is created within the department that replicates the working relationships found in practice. A direct link to the client and the obligations articulated in the scope of services, schedule and cost-recovery fee proposal establishes a heightened level of student responsibility and quality of output. The working relationship that flows from this program allows the faculty to model the professional behaviors and values associated with professional practice success.

The research question associated with the CDT is an attempt to evaluate student and client experience and the benefits to both. The data collected was gathered via surveys through open-ended questions collected at the conclusion of each project. The data indicates a unique learning experience, a sense of professional accomplishment, real-world portfolio enhancement and growth in student confidence. Client surveys indicate a high level of satisfaction with the adherence to the scope of services and schedule, the level of professional responsibility, and the design and graphic quality of the work. A juxtaposition of these two sets of data speaks to the value of the program and suggests that other landscape architecture programs may benefit from a similar model.

When measured against the traditional academic studio, the CDT creates a unique linkage between the practice of landscape architecture and client objectives, meshes volunteer student teams that include freshman to third-year graduate students, establishes the relationship between practice and business responsibilities, and builds the hierarchy and processes found in a professional practice studio.

# SUSTAINABILITY



# Understanding Transit Ridership: Using regression analysis to generate ridership forecasts for better performance measurement of transit agencies.

**Torrey Lyons** University of Utah

Ridership is the most ubiquitous performance metric for transit agencies around the country. Many agencies set annual goals for ridership, against which they are measured in the coming year. There are two general issues with this approach: 1) ridership goals usually come from relatively arbitrary estimates, often looking at recent trends with little consideration of the factors actually impacting ridership, and 2) many of the factors impacting ridership are outside the control of agency managers (Taylor & Fink, 2003). This study focuses on the Salt Lake City region, and its transit agency the Utah Transit Authority (UTA).

Two significant contributions have been made through this work to literature on the factors impacting transit ridership. The Salt Lake City region is unique in many ways from other areas which have previously been examined. Much of the existing research focuses on major metropolitan areas where transit systems and populations have been relatively stable. The Salt Lake City region has experienced rapid population growth over the study period, as well as significant improvements to its transit system. This allows for new variables such as rail miles and revenue miles per thousand population to be considered. Also, the examination of a less prominent metropolitan area can determine the generalizability of previously published relationships between well-established factors and transit ridership.

Additionally, the majority of studies have applied multivariate regression analysis to time series data to generate elasticities for the factors they examine. However, only cursory acknowledgement is given to the issue of autocorrelation with this approach. While still applying regression analysis methodology, this study attempts to address this issue, along with other threats to the statistical validity of the models presented. A regression subset analysis is used to derive a parsimonious model from the base model. In total, four models are presented: A base model and parsimonious model for total transit ridership, and a base model and parsimonious model for bus-only ridership. A variety of tests are applied to the parsimonious models to ensure their validity. A detailed methodology for using elasticities generated by the regression models to forecast ridership is also presented.

# A Comparison of Design Processes Between Sustainable SITES™ - Certified and Non-Certified Urban Open Space Projects

**Jennifer Wiseman** Utah State University  
**Ole Sleipness** Utah State University

This exploratory study examines how design processes differ between SITES™ certified and non-certified urban open space projects. While many landscape architects implement sustainable design protocols into their design processes regardless of SITES™ certification, as demonstrated throughout Sustainable Site Design, (Dinep & Schwab, 2009), this study analyzes and documents the presence and nature of some significant differences. Consequently, findings strengthen the objectives of SITES™ certification for garnering recognition and validation of existing landscape architectural practices, while increasing the value of designed spaces (“U.S. Green Building Council,” n.d.).

In response to an emerging market demand, the Sustainable SITES™ Initiative was modeled after LEED certification and formed to establish a rating system and comprehensive framework of performance guidelines for landscape architectural project development. Collaboratively established by ASLA, Lady Bird Johnson Wildflower Center at the University of Texas at Austin, and the United States Botanic Garden (Calkins, 2012), as of June 2015, the Green Building Certification, Inc. of the U.S. Green Building Council acquired SITES™ and will oversee future certifications. SITES™ was formed to address the need for a coordinated landscape architectural rating system that could be applied independently or synergistically with LEED certification.

As Francis (2001) states, “The primary body of knowledge in landscape architecture is contained in the written and visual documentation—that is, stories—of projects, be it well-known ones such as New York’s Central Park, or more modest projects such as a small neighborhood park. Together, these cases provide the primary form of education, innovation, and testing for the profession” (p.15). Using a comparative case study analysis, this study compares and contrasts comparably sized and situated projects completed by three firms for qualitative differences among their design processes. Data from interview responses, review of project archival records, and examination of built artifacts detail the patterns, similarities and contrasts of the design processes of three SITES™ certified urban open space projects and three similarly situated non-certified urban open space projects in the Puget Sound region of Washington. These projects include all SITES™ certified projects in Washington state that are reflective of the public urban open space typology, or as Jan Gehl (Gehl, 2011) called the “life between buildings.” Project selection provides comparable review of variables and elements of design processes among projects.

This study pinpoints components of quality landscape architectural practices in sustainability, illustrates how efforts to achieve certification augment these established practices, and evaluates landscape architecture’s commitment to sustainable development. While SITES™ certification provides valuable branding of projects’ sustainable practices, many of these practices form a common thread among long-established landscape architectural design processes. This study identifies dimensions of commonality between SITES™ certified projects and those that while lacking certification, still possess substantive sustainable qualities. Additionally, this study identifies connections between emerging market demands and professional practice.

# Reclaiming greens in the Southwest: Strategies for transforming golf courses into multiuse desert communities

**Kelly Cederberg** University of Arizona

[kellyv@email.arizona.edu](mailto:kellyv@email.arizona.edu)

**Margaret Livingston** University of Arizona

[mlivings@email.arizona.edu](mailto:mlivings@email.arizona.edu)

Golf courses nationwide are struggling. As the popularity of golf grew in the 1990's and real estate along golf courses brought in high property values, the building of golf courses in the southwestern U.S. boomed. However, supply of golf courses has outgrown the demand for the sport (Downey, 2011). The National Golf Foundation reported that 174 golf courses permanently closed in 2014. This shows a continuing trend with the number of golf course closings outnumbering openings every year since 2006 and the trend is expected to continue ("Golf Facilities in the U.S.," 2015). Cities and developers are facing a new problem: What to do with these high-water-use, underused, bankrupt golf courses? These troubled golf courses provide opportunities for redesigning communities in order to make them more sustainable and resilient while preserving and enhancing much needed open space in urban areas.

This work explores the benefits and constraints of redesigning golf course communities in order to 1) accommodate a larger variety of users 2) diversify often poorly planned subdivisions 3) improve ecological conditions. The research demonstrates environmental and social benefits that result from certain design elements resulting in a series of design outcomes. Environmental design outcomes include adopting a predominantly native landscape typology in order to conserve water as well as implementing green infrastructure on a larger scale in order to reduce flood risk, harvest and clean stormwater. Golf courses also provide opportunities to create larger patches and corridors of wildlife habitat within urban areas. Social design outcomes include using golf course land to provide much needed access to trails, recreation and open space. Last, by allowing appropriate mixed-use infill development, communities may benefit with a larger diversity of housing options and a potential decrease in vehicle dependency. Design implications will be demonstrated through the redesign of a golf course in Tucson, AZ.

Methods for investigation include a review of associated literature and an analysis of other golf course repurposing projects. Results provide: 1) a conceptual framework for design retrofits in similar golf course communities in the Southwest, and 2) design outcomes that can be adapted to similar golf course repurposing projects throughout the U.S.

# Designing for Modular Composting at the Community Scale

**Andrew Schlesinger** Rutgers University  
[andrewpschlesinger@gmail.com](mailto:andrewpschlesinger@gmail.com)

**Richard Alomar** Rutgers University

With most landfills existing on the fringes of developed places, the sanitary response to trash eliminates refuse from the individual's and community's consciousness, transporting waste "away" from sight and mind to unimagined landscapes (Nagle, 2013). While this rapid response to dealing with America's trash epidemic has sustained the consumer tendencies of the United States, the carting off of trash to distant places perpetuates our inability as a country to separate and cycle our waste streams (Engler, 2004). As a nation, we have lost the ability to efficiently and creatively deal with our trash (Humes, 2013).

While noteworthy landscape designs have emerged exploring the potentials of landfills and large waste spaces (Fresh Kills, Daney Park, Sky Mound, etc.), these projects are generally located away from the patterns of everyday life. And while these sites have produced ecological constructs for how we perceive complex, layered spaces (Thayer) existing waste sites provide few examples of spaces designed for the community scale. This paper identifies the need for additional community waste landscapes and explores opportunities for integrating closed-loop, composting sites into the center of urban life. It reviews developments in New York City's Department of Sanitation's Compost Project, an initiative intended to popularize composting "by giving New Yorkers the knowledge, skills, and opportunities they need to produce and use compost." (DSNY) Three selected case studies (listed under Citations) have been chosen to include a variety of composting scales and methods along with a range of compost site designs and site experiences - specific criteria informing the design of new urban composting spaces.

After reviewing case studies and gleaning best urban composting practices, this paper designs, proposes, and implements a composting network for the city of New Brunswick, NJ. The proposed network combines mobile food scrap collection locations with stationary compost cycling centers. Integral to this proposal is the design, and construction of Compost Cubes - three-foot, translucent cubes on wheels. These flexible landscape elements arrange temporary food-scrap collection spaces in the urban landscape, making the process and collection of compost visible for residents to experience. The design and arrangement of Compost Cubes within the larger urban composting network is intended to shift the perception of community waste collection - reframing the mundane task of waste collection as an opportunity for expanding the scope and pedagogy of landscape architecture. By bringing composting out of community gardens and "expected sites" in the landscape, this proposal explores methods for popularizing composting by demonstrating waste cycling amidst urban activity. In doing so, it reconnects composting network participants with the opportunity to responsibly cycling their waste - visually demonstrating food cycling and soil production within a replicable model that can be implemented in communities and urban landscapes across the country.



# Into the meadow and rain-garden: A discussion of plans for and the broader implications of on-campus green infrastructure research, teaching, and outreach

**Lee Skabelund** Kansas State University

[lskab@ksu.edu](mailto:lskab@ksu.edu)

**Katie Kingery-Page, Jessica Canfield, Stacy Hutchinson** Kansas State University

Several green infrastructure demonstration projects have been implemented on the Kansas State University campus in response to faculty research and outreach interests, student desires for design-build projects, and an aim to create a more sustainable campus. Green infrastructure projects can readily connect landscape architecture faculty and students with those from other disciplines (including engineering, construction, biology, ecology, agronomy, soil science, horticulture, architecture, and visual arts).

Connecting planning/design with other disciplines and local communities (Angotti et al. 2012) is vital if we are to effectively address the range of ecological, social, and economic concerns related to creating livable, regenerative, adaptive cities (Palazzo & Steiner 2011). In particular, the design-build and monitor-manage-adapt approaches to service-learning in landscape architecture employ the concept of action-based research and outreach (Skabelund & Gabbard 2010). Green infrastructure that is designed, created, monitored, and maintained on a university campus can educate students, administrators, practitioners, and the public in systems-thinking, and benefit larger landscapes (Rouse & Bunster-Ossa 2013).

The USEPA has been advocating for green infrastructure design in the United States for many years, with recent emphasis given through the USEPA Campus RainWorks Challenge. More comprehensively, the Sustainable Sites Initiative (SITES) seeks integration of design strategies (Calkins 2012; GBCI 2014) for the purpose of creating sustainable communities. What should USEPA and SSI guidelines and programs mean for landscape architecture education? Since landscape architects are frequently part of interdisciplinary professional teams (including in envisioning and implementing green infrastructure) we should ask: are we effectively educating our students to help create sustainable sites and systems, and evaluating long-term project success via hands-on monitoring and adaptive management?

A proposed plan for studying green infrastructure on the K-State campus is under development, with an eye to sharing what we learn via classwork, then communicating this to the public. Active-learning research by faculty and students will include assessing before-and-after stormwater runoff characteristics, soil infiltration capacity, pollinator use, vegetation diversity and cover/biomass, and site irrigation and maintenance procedures. Ongoing discussions encouraged by this presentation need to address the following questions about green infrastructure research and outreach in landscape architecture education: What are the skills and areas of knowledge related to green infrastructure design, implementation, monitoring, and management needed in professional practice?

How can landscape architecture educators explicitly incorporate key purposes and objectives from SITES and the Campus RainWorks Challenge to build student expertise in integrative and interconnected green infrastructure planning, design, and management?

# Green Roof or Solar Panels?

**Kirk Dimond** University of Arizona  
[kirkd@email.arizona.edu](mailto:kirkd@email.arizona.edu)

When it comes to sustainable building involving a roof, two solutions typically come to mind: vegetated roofs and solar panels. Both solutions generally have a favorable perception and have been accepted as responsible green-building practices (Hanley 2015, Worldwide 2015). However, the two systems are quite different, even opposing in many regards, and can compete for space in a project. So which solution is the best when it comes to a sustainable design? What site analysis and design considerations can influence the choice of one green method over the other?

On one hand, a green roof can aid with site stormwater runoff quantity and quality while also providing habitat for pollinators and reducing the Urban Heat Island Effect (Oberndorfer, Lundholm et al. 2007, Susca, Gaffin et al. 2011, Bianchini and Hewage 2012). Solar panels, while typically aesthetically inferior to a green roof, is a decentralized clean energy source that has a number of environmental benefits (Jacobson and Delucchi 2011, Aman, Solangi et al. 2015). However, many of these benefits result more off-site and the visible environmental effects on the project site are not always as apparent or existent.

Considering the wide number of researched benefits and performance levels of vegetated roofs and solar photovoltaic systems in various locations, this paper brings them together to compare the two through a literature review and comparative analysis of those findings. The literature was gathered, sorted, and analyzed to reveal how environmental factors on a variety of scales involving climate, water, and energy, interplay with economic and social influences and impact the decision of which roofing system would be most sustainable.

It is clear from the research findings that there is no one-size-fits-all answer to the question, but that vegetated roof and solar photovoltaic system performance and benefits vary depending on regional, landscape and site factors. For sustainable design, specifying one system or the other should not be an afterthought. A thorough site analysis for each project must weigh the contextual conditions and concerns at a variety of scales. The proposed components and placement of the system to be used must also be carefully considered to determine the system with the maximum sustainable benefit to a project and region.

# Investigating Climate Justice in Green Infrastructure Planning: A case for the Huron River watershed, Michigan

**Chingwen Cheng** Arizona State University

Green infrastructure has been recognized as a critical strategy in climate change adaptation (e.g., reduce heat and floods) as well as climate change mitigation (e.g., carbon sequestration) (Demuzere et al., 2014). A recent study has conceptualized green infrastructure capacity from biophysical and social-political feasibility in addressing climate change adaptation (Matthews et al., 2015). However, the issue of equity in planning is overlooked in green infrastructure planning under the consideration of climate justice. Climate justice refers to uneven distribution of climate change-induced environmental hazards (e.g., floods aggravated by climate change impacts in terms of their frequency, intensity, and geographical spread) among socially vulnerable groups—the elderly, children, women, migrants, non-whites, and the poor (Walker & Burningham, 2011). While green infrastructure can serve multiple ecosystem services in the inter-linked social-ecological systems (Hansen & Pauleit, 2014), there is a need to address equity under the challenge of climate change in green infrastructure planning. This paper aims to provide a climate justice assessment framework that can be integrated into green infrastructure planning process for climate change adaptation.

A Climate Justice Index was developed through a synthesis of a flooding hazard index, an environmental hazard index, and a Social Vulnerability Index in order to identify vulnerable population who would be exposed to environmental hazardous sites susceptible to water quality contamination aggravated by increased flooding hazards associated with climate change impacts. In addition, the availability of green infrastructure system that includes open space, parks, and vegetated areas was analyzed as a proxy for biophysical adaptive capacity for climate change. The climate justice assessment framework was applied to the Huron River watershed in Michigan as a case study through hydrological modeling, GIS spatial analysis, and statistical methodologies. Climate justice hotspots were identified to illustrate areas that are the most socially vulnerable to climate change-induced environmental hazards and with the least green infrastructure resources.

The results revealed that the more urbanized areas are more sensitive to climate justice combined with the issue that little green infrastructure investments have been taken, especially in communities with a majority of socially vulnerable groups. This study demonstrates the important step of assessing climate justice in green infrastructure planning applying equity and climate change impacts as critical criteria for decision-making priority in green infrastructure investments. The study framework can be applied to other watersheds and cities in order to enhance resilience and sustainability in communities under consideration of climate justice.

# URBAN DESIGN



# Safe urbanism: role of design retrofits, design thinking and planning culture in reducing accidents

**Archana Sharma** Morgan State University

[archana.sharma@morgan.edu](mailto:archana.sharma@morgan.edu)

National Highway Traffic Safety Administration (Feb 2015) report that fourteen percent of pedestrians died in traffic crashes in 2013. Such a loss of life provides motivation for this paper to start inquiring into the influence of designers onto such statistics. Whether we can traffic crash relates pedestrian fatality rate using our instrument of design? This paper investigates co-relation between street pattern, design and safety, which is, currently not clearly established.

First step in this study involves a review of design and space syntax of accident sites. Archetypal typology and design syntax of streets located high residential areas abutting national and state highways would be used as key context for this study since these are high-risk areas for accidents resulting in human fatalities. Historical maps of streets prone to accidents are resourced as well. Before and after design syntax and patterns of streets are then transposed over accident rates from both time periods. This provides data on accident rates on the streets before and after design retrofits, thus prompting findings on co-relation of pedestrian fatal accident sites and design syntax. Ensuing design recommendations for safe streets are based in critical analyses of this co-relational study. The recommendations will respond to and comment on -futuristic design predictions and concepts of transportation modalities, urban planning and human behavior.

This inquiry into traffic safety oriented “safe urbanism” is positioned in social sciences, intersecting presents an interdisciplinary perspective on transportation planning through a landscape planner’s view. In doing so it raises question on silo-ed design practice in “transportation design”, should it not be an inclusive design, including voices on design and human behavior and landscape planning, to name a few. Is this siloed’ practice partly to blame for high rates in accidents, because design and human behavior is out of sync. Should we try to change culture based on our design or design in response to culture is the age-old question, revisited here.

# The Role of the Creative Class in Small Town Regeneration: A Case Study of Kinston, NC

**Beverly Bass** California Polytechnic State University

Small towns are subject to decline as industries migrate to other regions or countries (Fuguitt, G. et. al., 1989). One such case is Kinston, NC. Kinston was established as an English settlement in 1762 (Johnson & Hollomon, 1954) and thrived through textiles and tobacco. Decline began in the 1960's with the export of these industries. Kinston has since struggled to regain an economic foothold. Poverty rates for Lenoir County rose above 25% by 2011 (US Census, 2012). Recent events appear to be prompting economic development. An embryonic arts and culinary movement are finding purchase in the city. Several restaurants have started to transition Kinston into a food tourism destination, one of which is the subject of a PBS series, *A Chef's Life®* (Severson, 2015; Howard, 2015). An artist community is being established with several new galleries. The city planning department recently created an artist zone overlay in part of downtown with the intention of offering low cost live/work space to an entrepreneurial creative class (Satira, 2014).

The purpose of this study is to determine if the rise of a creative class is serving as the catalyst for recent change and if not, what factor or factors have contributed to these changes? Creative industries have been shown to increase tourism and regeneration (Wood and Tayler, 2004; Bell, 2005). This research fills a gap in the literature in that there is a paucity of research into small town regeneration in the United States. Much of the existing research occurs internationally. Still, international and domestic research concludes that the greatest success in small town regeneration results from public/private partnerships that leverage existing assets at both local and regional scales. (Brown, 2013; Cebulla, et. al., 2000; Flora, et. al, 1992; Jeannot and Goodchild, 2011; Lewis, 1998; MacDonald and Jolliffe, 2003; Nel and Stevenson, 2014; Osborne, et. al., 2004). This study will add to this literature by detailing the mechanisms that have led to regeneration in Kinston and will add to landscape architects understanding of the issues at play when approaching small town regenerative efforts.

A case study of this regenerative process will be presented that will include a literature review, overview of the issues, and interviews with city officials, non-profits, business owners and other key players. Findings about cooperative partnerships between public and private interests and the role that artists and creatives are having in this effort will be presented.

# A Current Inventory of Vacant Urban Land in America

**Galen Newman** Texas A&M University

[gnewman@arch.tamu.edu](mailto:gnewman@arch.tamu.edu)

**Ryun Jung Lee** Texas A&M University

**Ann Bowman** Texas A&M University

Vacant Land is increasing in U.S. cities. The overall data of the vacant land in the U.S. investment have not been constantly collected and analyzed over time, while the issues related to the vacant land have grown continuously in the era of urban decline and in the context of urban health and safety. Research on the vacant land tends to focus on the city- and neighborhood-scales, analyzing the specific relationship between the neighborhoods and the physical conditions of the vacant land. Along with the research on the specific cases, which should not be neglected, we should also look into the overall changes in the vacant land patterns and characteristics.

Past studies on the vacant land inventory in the 20<sup>th</sup> centuries have shown that the vacant land in the U.S. has been in decrease (Bowman & Pagano, 2000; Niedercorn & Hearle, 1964; Northam, 1971). In the past era of urbanization, urban sprawl were prevailing with the great support of transportation and technology, showing rapid urban growth and distinctive urban patterns over regions, i.e. Sunbelt and Rustbelt cities, covering greenfield and existing vacant land. These patterns have, however, changed in recent decades due to the shift of industry and the changes on the economic context of the cities. The city of Detroit and Cleveland are not the only cities that are in decline, but many Rustbelt cities are confronting the population loss and urban decline. The increasing vacant land has been the most obvious concern in these cities. The earliest study gauging vacant U.S. urban land was performed in 1963 by Neidercorn and Hearle entitled 'Recent Land Use Trends in 48 Large American Cities.' On average, 20.7% of urban land was considered vacant. Northam conducted a similar study in 1971 entitled 'Vacant Urban Land in the American City' with cities reporting 24.5% of their lands vacant. The most current attempt was in 2000 by Bowman and Pagano. An average of 15.4% of each city was reported vacant with a mean of 2.7 abandoned structures per 1000 persons.

The purpose of this study is was to firstly look into thegather a current inventory of vacant land/abandonment in the urban U.S. nationwide vacant land patterns,, compare examine the vacant land trends with the characteristics of the city as well as the regional contextsby region, and compare results to previous surveys. . The cities experiencing the Land area change per city/region, area and population changes, and vacant addresses were also used as measures are expected to have changes in the amount and the properties of the vacant land as well. We have also looked into the vacant structures, which are considered to have more severe impacts on the quality of life in general, to see if the structures and vacant land can be analyzed in the same city contexts.

An online survey was performed and distributed to all U.S. the cities with 100,000 or more population (215 in total) from Ffall 2013 to Ssummer 2014. The study had a 58% response rate (124 in total) with 79 cities having available vacant land data and The survey questions have asked forgathered data on the amount, types, and other characteristics, and designation of vacant land/vacant addresses in each city. Data from the The vacant land data collected from the survey have been compared to the past three periodic nationwide studies on the vacant land, tracking back the vacant land data from the past. . The data on the vacant structures used in previous studies have been vary and subjective limiting the validity of the data. This study uses the United States Postal Services (USPS) data on the vacant addresses cwas also collected from the U.S. Department of Housing and Urban Development to assess abandonment. which includes both residential and

# CONSIDERING COMPACT DEVELOPMENT: PREFERENCES IN NORTHWEST ARKANSAS WITH REGARD TO TRADING OFF PRIVATE SPATIAL AMENITY WITH COMMUNITY BENEFITS

**Carl Smith** University of Arkansas  
[cas002@uark.edu](mailto:cas002@uark.edu)

**Noah Billig** University of Arkansas  
[nsbillig@uark.edu](mailto:nsbillig@uark.edu)

Recent population increases in Northwest Arkansas have been several times that seen elsewhere in the state, with a 2.7% annualized growth rate forecast until 2020 (Hamilton, 2006). This burgeoning region – specifically the college town of Fayetteville – has been lauded as a place to do business and retire (Money Magazine 2015; Northwest Arkansas Council 2011). Fayetteville’s comprehensive plan speaks to balancing the opportunities of population growth with preserving natural and built assets (City of Fayetteville 2015). This challenge is shared throughout the region, and points to the need for greater residential compaction. However, previous research by the authors found a lack of public support for denser housing in Northwest Arkansas; while a self-selecting sample were overwhelmingly supportive of regional greenspace preservation and public transit, there was low support for concomitant residential compaction with its smaller homes, yards and reduced parking. However in this earlier work, respondents were not provided the opportunity to trade-off of one popular construct (low-density housing with large homes and yards and abundant parking) with another (preserving regional greenspace or facilitating public transit). The current study builds on our previous research by asking respondents to balance these competing considerations through a series of tradeoff statements; a tested methodology shown to provide a rich understanding of public opinion (Lewis & Baldassare 2010). Furthermore, the current study is more reliably based on a representative sample drawn from a survey of 3,000 adult residents across the region. From our analysis of responses, we found clear evidence that current living environment is closely correlated with preference choices. The proportion who would sacrifice private spatial amenity for regional benefit, compared to those who would not, was significantly greater among respondents with attached and/or rented homes than those with detached and/or owner-occupied homes. This chimes with previous work that suggests that attitudes are informed by current living circumstances (Talen 2001). These findings suggest that there is much work to be done on communicating the benefits and qualities of compact living, should emerging planning policy and general public preference be reconciled – particularly considering the majority of respondents report currently living in a single-family detached home (80%), own their current residence (73%), feel satisfied with their current dwelling (91%) and indicate that they prefer to live in a single-family detached home (90%).



# The Tremendous and Troubling Success of New York City's High Line Park

**Clark Taylor** UCLA Department of Geography

The High Line Park in New York City has been almost universally accepted as a successful example landscape architecture and urban design. Not only has the actual design of the park been heralded as a tremendously innovative and provocative way of interpreting the contemporary city, but the process by which the park was funded, developed and integrated into the neighborhood is seen as a new and efficient way to provide public spaces in the face of funding shortfalls, spatial limitations and globalized urban development. This paper examines, with equal parts celebration and criticism, the High Line Project as an urban intervention and as a political and social space. The elevated track and separation from the street grid create a new way of seeing New York City. Building on the landscape analysis techniques of Denis Cosgrove and others the paper offers a description of exactly how the High Line provides this “new way of seeing” and explores the cultural and social underpinnings and consequences — good and bad — of the park. The High Line as a successful implementation of landscape as an instrument in reshaping the urban experience is contrasted with an analysis of the troubling and profound power of the High Line to create spaces of exclusion, surveillance, segregation and control. Approaching the issue from a number of different angles, this paper seeks to problematize both the spatial and political functions and mechanisms utilized to create and maintain the park. The thesis that several of the specific physical, cultural and infrastructural elements that make the High Line such a unique and enjoyable space are the very same elements that make it a powerful tool in urban segregation, gentrification and social control is presented and explained. Three elements, inseparable from the very nature of the park and fundamental in the success and beauty of the High Line are examined in detail. Those characteristics are: 1) the separation of the park from the urban street grid, 2) limited and discreet points of access, and 3) private control (both explicit and implicit) of public space. The paper points to these three characteristics as fundamental to the unique experience enjoyed by visitors of the High Line while also illustrating the dangerous ways in which the High Line acts as a nearly perfect manifestation of entrepreneurial urbanism so common in large cities during the first two decades of the 21st century.

# OpenCity: Social Networks for Participatory Urban Design

**Nina Claire Napawan** University of California, Davis  
[ncnapawan@ucdavis.edu](mailto:ncnapawan@ucdavis.edu)

**Brett Snyder** University of California, Davis  
[blsnyder@ucdavis.edu](mailto:blsnyder@ucdavis.edu)

**Sheryl-Ann Simpson** University of California Davis  
[ssimpson@ucdavis.edu](mailto:ssimpson@ucdavis.edu)

The current debates and dilemmas in urban environments require cities to engage as broad a public as possible in determining their future. One significant tool for engaging communities in the critique of existing and proposed built environments is digital social networking. The proliferation of the social internet, of web-based and app-based social media tools, is an important defining phenomenon of the contemporary moment. Social media opens new opportunities for data-intensive humanistic research into contemporary text and visual content, along with auxiliary data, including geolocation, and data tracking the movement of and connections between content. This provides opportunities for designers, planners, and other urban decision-makers to tap into existing networks to gain greater understandings of how communities perceive, use, and contribute to their built environments.

This presentation utilizes three environmental design projects within the San Francisco Bay Area as case studies of social media integration for community outreach and participation: #SFOPENCITY, a public exhibition that invites local community-members to interrogate their existing urban landscapes through popular social media outlets; #OurChangingClimate, a research and design project that empowers Oakland youth to develop physical and digital exhibitions to document and share their experiences of climate change; and #FOGWASTE, a public art installation that seeks to bring greater awareness of San Jose's vital infrastructures to community members and encourage greater urban environmental stewardship. While each project tackles a separate dilemma within the urban environment, all three utilize social media as a means for broadening the participating audiences and diversifying perspectives.

Through a brief discussion of each projects' goals and processes, the benefits and challenges of social media integration will be presented, including techniques for addressing the digital divide and integrating community members with limited interest or experience with social media. Ultimately, this presentation presents the benefits of social media integration with the environmental design process, utilized alongside traditional methods of community outreach and participation. By embracing new technologies for connectivity and networking, these case studies demonstrate new techniques to design more inclusive and informed urban environments.

# Landscape Urbanism: An Exploration in Connecting the (Dis-connected) Green to the (Fragmented) City

**Ming-Chun Lee** The University of North Carolina at Charlotte  
[ming-chun.lee@uncc.edu](mailto:ming-chun.lee@uncc.edu)

This paper documents the work of students in School of Architecture at UNC Charlotte in spring 2015. Following the apprenticeship model of learning, this studio worked closely with city planning officials and local designers to explore potential urban design improvements, strategies for integrated open spaces, and impacts of mixed-use development in Charlotte's University City area. In particular, students used University City as testing ground for understanding potential roles of urban parks and associated green infrastructure in promoting sustainable urban development and making University City a vibrant place.

The infrastructural role of landscape as the underlying operating system for future urbanism has been broadly explored by many thinkers and designers over the past century, from Geddes to Gottmann, Mackaye to Mumford, Olmsted to Odum. The traditional notion of landscape as infrastructure stems from the ritual of aesthetic thinking in the 19<sup>th</sup> century, which sees nature as an object, transported by means of green infrastructure into the rapidly growing industrial cities, in order to supply estranged urban dwellers with nature. In light of the current discourse on sustainability and how to cope with climate change and vanishing natural resources, many now believe that a predictable and productive performance is attributed to nature. Its capability to generate renewable energy and healthy food, to clean water, to purify air, etc., is based on the idea of deploying ecosystems as services so that landscape functions as a stable system serving human needs. Green infrastructure is the technology that not only provides ecosystem services, but also ensures their production.

This project intended to build on these two established notions of landscape as infrastructure, aesthetic on one side and ecological on the other, and go further to think of landscape as the basic building block of contemporary urbanism, as the “structuring and morphological medium” of human settlements. The premise is that cities are the accumulation and the integration of many individual physical entities, themselves shaped by cultural, social, and economic forces over time. Landscape elements are among such key entities as buildings, streets, blocks, and monuments together act as “place-making” catalysts to shape the form of our cities. Landscape becomes both the lens through which contemporary cities are represented and the medium through which they are constructed.

This studio engaged in both collaborative research and design environments. Working individually and collectively during the research phase of the project, students conducted site mapping, data analysis, and precedent research. With guidance from our advisors, they mapped out the area's carrying capacity for future urban development and green infrastructure expansion. Research activities were focused on the following areas: environmentally sensitive areas, existing green amenities and recreational spaces, county-wide framework for green infrastructure, existing land development patterns, land use regulations, existing transportation networks, demographic structure, socio-economic and physical structure of existing neighborhoods, and employment clusters.

# Security in Future Urban Environments

**Allan W. Shearer** The University of Texas at Austin

This paper considers the implications of future urban environments on national, environmental, and human security. The research was done in support of the NATO Urbanization Project, which was undertaken to consider how emerging concentrations of development may affect security activities related to civil support, crisis management, and disaster response.

In 2007, for the first time, more people lived in cities than in rural areas. Looking forward, it is anticipated that by the end of this century up to 80% of the world's 9–11 billion people will live in urban areas, with most of this growth occurring in developing countries. A general question to be asked is if the expected quantitative changes in population and density may lead to qualitative changes in the ways cities function? With regard to security concerns, will future cities, nation states, or international alliances (such as NATO) have the capacity to respond to the spectrum of stresses that come with increasingly large cities? Specific topics for discussion include political relationships between patterns of conurbation and governance organization, economic relationships among cities rather than between a nation state and its cities, environmental relationships between infrastructure and (formal and informal) settlement.

These issues are approached by considering the city as a complex, emergent system that combines flows (people, materials, energy, etc.), heterogeneous activity, and built form. Elements in the system are defined through the PMESII (Political, Military, Economic, Social, Infrastructure, Information) framework, which was developed to support understandings of operational environments and is commonly used across military commands and diplomatic bureaus. Within each of the six framework categories, key factors, linkages between factors, and recognized uncertainties are discussed. Relationships across the categories are explored through ten case studies that represent a variety of contexts (Basra, Caracas, Delhi, London, Johannesburg, Kinshasa, St. Louis, St. Petersburg, Shenzhen, and Tripoli). The case for each city combines information about its present conditions and published conjectures about its future.

The investigation contributes to the reimagining of the city and the urban landscape in an increasingly globalized world. It advances a position that the city be considered as a primary unit of analysis in addition to the nation state in geopolitical discussion. It draws attention to different dynamics that may lead to an escalation from governance through routine police powers to one of extraordinary security actions. By examining interactions among specific urban stressors, it also suggests possible paths for de-escalation.

# Suburban Terracing: experiments in topographically responsive urban design

**Karl Kullmann** University of California, Berkeley

Terraced site works first occurred in California in the 1950s in response to suburban expansion into mountainous areas. Referred to as “mountain cropping” (Bronson 1968, 35), the practice permitted standardized flatland suburban development models to be established irrespective of site conditions. Following the influence of US suburban ideals and practices, large-scale earth works began to emerge in Australian suburban development in the 1970s. In Western Australia in particular, mining-scaled earthmoving processes enabled steep coastal sand dune terrain to be readily remodeled to facilitate rapid suburban sprawl. By the mid 1980s, site preparation had evolved to the total re-engineering of natural topography into suburb-scaled systems of level lots retained with limestone block walls.

Terracing continues to offer numerous development, engineering, urban, and architectural performance advantages over older suburbs that were developed with limited reshaping of the natural terrain. However, the expansive scale of terracing in the suburban context produces numerous negative biophysical and phenomenological consequences. These include loss of topsoil and native vegetation and erasure of the intrinsic role that natural topography exerts in local character and place making (Author 2014a; 2014b).

In response, local planning policies adopted in the 2000s aim to minimize the impact of terracing while simultaneously mandating improvements to a range of standard urban performance criteria. In practice, the two objectives appear incongruent, whereby the application of urban design principles developed in Europe and the US coincides with higher retaining walls in the most recent coastal suburban developments.

Given the apparent incongruity between local terrain and unmodified urban design models imported from abroad, the article tests mechanisms for improving the conservation and expression of natural topography in current coastal suburban development. Set within the general framework of conventional suburban development practices, the research considers which factors hold greatest potential for improving topographically sensitive design at typical residential densities.

This objective is explored through design scenarios for a greenfield development site on the northern periphery of Western Australia’s capital city of Perth. The scenario methodology permits equitable detailed comparison of the impacts of diverse planning approaches (Chakraborty et al 2011). The topographic expression of each scenario is evaluated using four criteria drawn from the subjectivist framework for visual landform character analysis collated by Tveit, Ode and Fry (2006) and Ode, Tveit, and Fry (2008). The following criteria were selected for their applicability to the morphology of the study site: (a) imageability (the contribution of landmarks and other topographic elements to a strong visual image); (b) disturbance (the deviation of topographic features from the original context); (c) complexity (the diversity and richness of topographic features); and (d) naturalness (nearness to a preconceived natural state).

The research establishes that it is possible to design suburban layouts in a manner that reduces the need for extremely high terracing and improves the conservation of topographic character. However, actualizing these design initiatives will involve reevaluating many of the current practices in suburban development.

# Seven Decades On: landscape urban strategies for downtown Nagasaki

**Karl Kullmann** University of California, Berkeley

**Kushal Lachhwani** University of California, Berkeley

**Anna Thompson** University of California, Berkeley

**Michelle Hook** University of California, Berkeley

**Micaela Bazo** University of California, Berkeley

The recent 70<sup>th</sup> anniversaries of the atomic bombings of Hiroshima and Nagasaki illuminate the divergent fates of the two cities. As the first target, and as the larger, more accessible city, Hiroshima and its Peace Park have become a symbol for global peace activism and an international destination for memorial tourism. Nagasaki, on the other hand, has remained out of view, with its own Peace Park in need of renewal, and its urban framework disarranged by a legacy of piecemeal reconstruction and decades of ineffectual planning.

In spite of these problems, Nagasaki boasts a dramatic natural harbor and high historic importance as the sole gateway to Western commerce and culture during Japan's two centuries of self-imposed isolation. A new passenger ship terminal and the planned arrival of high-speed rail will dramatically increase the accessibility of Nagasaki and nearby attractions such as Battleship Island.

While promising, improved accessibility to Nagasaki will remain hindered by poor legibility and connectivity within the city. By virtue of past planning decisions and the topographic setting, Nagasaki is presently a traffic bottleneck, which creates conflict between vehicles and pedestrians. In addition to higher tourist numbers, pressure on the urban core will be compounded by the consolidation of the city, as a predominantly aging population vacates poorly accessed detached houses in the surrounding hills for apartments on the harbor.

The authors' urban design research project addresses these core issues of urban legibility, connectivity and consolidation by retrofitting a landscape-based urban framework into Nagasaki. The likely efficacy of a suite of targeted, incremental landscape-based urban initiatives is analyzed using a hybrid method of "design projection" and "engaged action" as defined by Deming and Swaffield (2011). As the legitimacy of both methods remains somewhat contentious within the field, the paper includes discussion on their value and drawbacks in this cross-cultural context.

Recent design research in the field of landscape/urbanism has focused on landscape strategies that are applicable immediately after major humanitarian events. While post-crisis landscapes represent an important area of focus (Bowring 2012), the case of Nagasaki demonstrates that the impacts of destructive events extend well beyond the "triage" phase. This research contributes to the extension of the terms of reference of landscape crisis strategies beyond the initial rebuilding phase to a much longer-term view (Copley, Bowring and Abbott 2015).

# Creating Resilient and Regenerative Urban Places: A Necessity

**Forster Ndubisi** Texas A & M University  
[ndubisi@tamu.edu](mailto:ndubisi@tamu.edu)

Creating Resilient and Regenerative Places: A Necessity Population growth is increasing rapidly, worldwide. The world is becoming more urban as well. Increased population growth in metropolitan areas has intensified burdens on landscapes to accommodate our daily needs for food, work, shelter, and recreation. Rapid urbanization influences ecological conditions by altering the physical mosaic of the landscape. One noticeable effect, landscape fragmentation (the division of large parcels of land into smaller lots), separates, degrades, and homogenizes habitats; in turn, affecting biogeochemical cycling and resulting in the erosion of biodiversity. Sprawl and climate change (severe and unpredictable weather events) exacerbate the negative ecological effects of urban development.

Despite an impressive array of urban spatial forms and structures, the complexity of these problems associated with rapid urbanization and climate change has made solutions increasingly difficult to attain. Based on empirical work involving extensive document review and key informant interviews, I offer a complementary spatial framework comprised of a set of principles to facilitate meaning dialogue in addressing these problems. At the core of these principles is the search for a pathway aimed at creating and maintaining adaptive and regenerative urban places. I explore supportive principles for creating such places. The principles include the design imperatives for change and uncertainty grounded on ecological science especially resiliency theory; conservation of ecosystem services; purposeful adaptation and mitigation of climate change impacts; adoption of regenerative practices, and commitment to place. I conclude by affirming that the effectiveness of these principles in managing growth in urban landscapes lies in their interdependencies which generates powerful synergistic effects.

# Wadi Hanifah: Landscape Infrastructure for the 21st Century

**Jean Trottier** University of Manitoba

[Jean.Trottier@umanitoba.ca](mailto:Jean.Trottier@umanitoba.ca)

The social and economic forecasts of our laissez faire attitude towards environmental accountability have put resilience - that new shade of sustainability - firmly on our national and international urban agendas, with profound implications for contemporary design education and practice. Within this context, the verbal fistfight between two of the most recognizable proponents of a 21st century urbanism - “new” and “landscape” urbanists - is as entertaining as it is counterproductive. Certainly, while both of these camps share a common environmental imperative their conceptual premises and preferred *modi operandi* differ significantly. What is less clear is whether either stance can claim greater substantive affinity with on-going environmental design innovations. My intent, in this presentation, is to approach this question through an argumentative reversal: what can state-of-the-art practice tell us about these two conceptual (and ideological) positions? The Wadi Hanifah Comprehensive Development Plan, in Saudi Arabia, will serve as a case in point.

Wadi Hanifah, led by Canada’s Moriyama & Teshima Planners and UK’s Buro Happold, is a radical realignment of urbanism and ecology. It establishes a framework for the environmental rehabilitation of a 1,700 square-mile watershed and the long-term management of its water resources and land use development. It also initiated a 10-year implementation program for the environmental restoration of 90-mile of river corridor, the construction of the world's largest urban wastewater bio-remediation facility, and the implementation of an ambitious reinvestment in Riyadh's public open spaces.

In 2010 the project received the Aga Khan Award for Architecture for “eloquently [demonstrating] an alternative ecological way of urban development” (jury citation). As such, it sets a precedent - and a path - for resilient urbanism and provides a credible benchmark for intellectual speculation.

The research for this presentation was funded in part by the 2015 Landscape Architecture Foundation Performance Series program and the Landscape Architecture Canada Foundation.



# URBAN ARBORETA: transforming ground through the Knight Cities Challenge

**C. Timothy Baird** The Pennsylvania State University  
[ctb3@psu.edu](mailto:ctb3@psu.edu)

The James S. and John L. Knight Foundation introduced their Knight Cities Challenge in 2014 that sought “new ideas from innovators who will take hold of the future of our cities.” This \$5 million per year grant program over a three-year period solicited ideas for “making the 26 Knight communities more vibrant places to live and work.” URBAN ARBORETA: transforming ground, one of 32 winners out of 7,160 applications nationwide for the first year of the three year challenge, proposes that vast acreages of dormant, vacant land in Philadelphia can be transformed into productive, inhabitable, performative landscapes through tree production for subsequent transplanting along streets, in parks, areas designated for reforestation, and along depleted riparian corridors. Through design, thoughtful research, engagement of critical resources and community input over the eighteen months of the grant, such production can become an integral component of a neighborhood environmental system of green infrastructure that includes stormwater management, bicycle and pedestrian circulation, soil production and composting operations, along with recreational programming.

Research and design of a hybrid landscape prototype will identify optimum approaches that meet production standards while interfacing with community aspirations. Coordinating with city agencies and schools, the prototype will offer job training in nursery management techniques and business: skills that will support careers in public service or in the private sector. The business plan will explore self-sustaining models that generate revenue; students in the MBA program at the Fox School of Business at Temple University will work with the project team to prepare the business model for the completed project. This project builds on past efforts of city agencies and organizations to advance conceptual ideas to a prototype tree production operation. It will allow testing of species and growing methods to ascertain suitability, allow refinement of spatial requirements, generate research data on efficacy, and provide a laboratory for the development of a long term maintenance and management strategy.

The project was the idea of and is managed by City Parks Association of Philadelphia and a landscape architecture professor at Penn State University. Several university landscape architecture programs have been invited to participate through their design studios, along with Penn State, to prepare the most innovative, cost-effective, implementable, and creative schemes with the final selection being made by a professional jury. This paper will describe the project process and progress since it began in June 2015, with installation of a portion of the prototype to begin in June 2016.

# Robert Zion's "impractical ideas" 50 years later: a landscape architect's vision for humanizing American cities.

**Carolina Aragón** University of Massachusetts Amherst

In the early 1960's, landscape architect Robert Zion was preoccupied with improving the daily experience of urban life in America. Frustrated with the characterless spaces resulting from the "occlusion of the imagination" in the work of planners who sought efficiency and economy, Zion engaged in a campaign to promote pleasure in city life through letters, articles, and proposals. His ideas, deemed "impractical" by Robert Moses, advocated for place-making strategies that increased comfort, pleasure, and sensorial experience in urban design.

Zion's imaginative proposals for New York City sought to humanize the metropolis through new types of urban public spaces that defied traditional notions of size, character, and location. These included "parklets," small parks in vacant parcels or parking lots, "zoolets" for the pleasure of viewing animals in the city, as well as "water squares" and floating restaurants to increase the social use of the city's waterfront. Zion argued for heightened attention to the quality and programming of these public spaces, to include elements that would stimulate the visual and auditory senses, provide comfort, and appeal to man's emotional affiliation to other living organisms.

This presentation uses classification and interpretive strategies to assess the significance of Zion's proposals as they related to the role of landscape architecture in urban place-making. A classification of human-centered design ideas for the improvement of cities was developed based on a literature review of Zion's writings, proposals and exhibition catalogs. These ideas were organized into categories relating to scale, temporality, programming, and sensorial experience. This catalog of ideas was compared against case studies of contemporary urban design projects. Parallels between Zion's proposals and work by the Tactical Urbanism, Urban Acupuncture and Biophilic Cities movements were drawn to demonstrate the contemporary relevance of Zion's human-centered proposals in contemporary urban design.

Zion's "impractical ideas" offer valuable lessons in place-making by promoting design that engages the human mind and senses in everyday public spaces. The incorporation of many of his ideas and principles in current practice demonstrate the visionary nature of his work. His writings and proposals are a testament to the rich potential for human-centered imaginative approaches to landscape architecture in urban environments.

# Taking the Inside Out - Las Vegas' First Parklet

**Ken McCown** Iowa State University  
[kenmccown@gmail.com](mailto:kenmccown@gmail.com)

**Jonathon Anderson** Ryerson University, Canada  
[j.anderson@ryerson.ca](mailto:j.anderson@ryerson.ca)

Downtown Las Vegas is one of the most parks poor areas among downtowns in mid-sized United States cities. Budget and political realities make it unlikely the area will gain any parks in the near future. Parklets, the reuse of parking spaces for small parks, are a potential means for gaining park space in downtowns. Is it possible to use these in lieu of parks? The downtown is becoming younger demographically. How can design connect this generation to conservation parks, which are usually outside of a metropolitan area? The Las Vegas environment is harsh – extremely hot and dry. More problems may occur from the nature of users in public space; there are a lot of celebratory people in the public realm that can cause damage to parks and street furnishings. Can parklets be designed elegantly, and still be resistant to potential vandalism? In this implementation project for the first parklet in Las Vegas, our design team explored these questions.

After studying and assessing the parks situation downtown to gather the data noted above, our team began doing Park(ing) Day installations in the downtown area. Through these installations, we were able to build an excitement for parklets, and garner potential project partners to fund the parklet. We worked in the community and with the AIA and ASLA chapters to have charrettes. Additionally, we explored an innovative use of digitally fabricated Corian (usually an indoor, kitchen countertop material resistant to heat) to finish the surfaces of the parklet.

We designed and constructed the parklet using traditional and digital fabrication techniques. The Corian surfaces were laser-etched and routed to describe local native species, as well as park locations where those species could be seen. A social media campaign tied to the parklet, literally through digital interfaces, allowed people to go online to a ‘virtual parklet’ site to get more information about parks in the area and native species.

Our findings include that a parklet can get built, and increase park space. Despite the city not having policy and codes to accept the parklet, we were able to get the project installed. We see increased use of outdoor space in the environment (park use in a parks poor area), activity in a social media realm focused upon the parklet (a sign of increased community use), and that the Corian surfaces and the other parts of the design withstood the environmental conditions intact.

# The Las Vegas Sustainability Atlas

**Ken McCown** Iowa State University  
[kenmccown@gmail.com](mailto:kenmccown@gmail.com)

The Sustainability Atlas is a large volume with a narrative of maps, diagrams and text explaining how public works support a metropolitan area. Its purpose is to explain in laypersons' terms, how infrastructure supports a metropolitan area, and what issues with respect to resilience exist within the systems supporting the metro. This report fills a gap in data in that comprehensive, place-based research tailored for capacity building and place-based resiliency planning does not exist. A sustainability atlas describes the water, energy, transportation, waste and food systems of a metropolitan area, and its ecosystem and environmental pollution context. These systems are examined within the context of a plot. What issues with respect to resilience exist? In the case of the Las Vegas Valley, drought, climate change, extreme sustained heat, and floods were threats to resilience.

Planning for mitigation, adaption, and transformation are necessary. Can an atlas help build an understanding of the nuances of resilience in a metro? Can it help build capacity in the stakeholders to understand how the systems supporting the city work and the hierarchy of issues related to them? Can it help the city understand what issues are critical to resilience and where successes were? Could the atlas and the process of making it build social relationships across systems?

A multidisciplinary team explored the systems of the Valley to understand how infrastructure worked, how it worked in the Las Vegas Valley metro and surrounding areas related to its infrastructure. The team created diagrams showing how the systems worked, and located them by mapping this information. The team worked with leaders in the Valley to generate the atlas, building relationships between stakeholders related to the infrastructure.

Our findings include that the atlas process can build social capital to respond to resilience, that laypersons can understand the atlas. Through this knowledge, people show increased interest in planning. Among several findings about the resilience of the water, energy, transportation, waste and food systems, we discovered Las Vegas to be extremely resilient, especially through its innovative water system and rebate programs. We found that high, sustained heat could create challenges in the transportation system and that energy was going through tremendous changes across all aspects of the system, creating several unknowns for the city. In this paper presentation, the author will reveal these details, as well as several others related to Las Vegas.

# Is Silver Zone effective in reducing elderly pedestrian car accident in Seoul, Korea?

**Yunwon Choi** Seoul National University

[yunwon.choi@snu.ac.kr](mailto:yunwon.choi@snu.ac.kr)

**Heeyeun Yoon** Seoul National University

[hyyoon@snu.ac.kr](mailto:hyyoon@snu.ac.kr)

**Eunah Jung** Seoul National University

[jea0610@snu.ac.kr](mailto:jea0610@snu.ac.kr)

Fatality rate among elderly road users has been increasing. Globally, pedestrian deaths comprise 22 % of all motor vehicle-related deaths and about 40% of them were of the elderly population. Korea is not an exception. Elderly fatality rate exceeded 36% of the entire fatality with rate increased by 8.1% from 1724 persons in 2011 to 1864 persons in 2012. Inaugurated in 2007 in Seoul, the Silver Zone is designated pedestrian safety zone for elderly pedestrians, adopting speed limit measures such as traffic signage and marking on road surfaces around public facilities, to caution drivers about presences of elderly pedestrians.

In this study, we investigate the effect of the Silver Zone in reducing elderly pedestrian car accidents, and further explore ways to improve its performance by suggesting physical measures and administrative protocols. On the first count, in order to see the effect of the Silver Zone, we use quasi-experimental statistical analysis, Difference-in-Difference. By deducting the difference of outcomes between two groups in two different periods - before and after the treatment, DID reveals the remaining “difference-in-difference” as a pure impact of the treatment controlling for all other factors that simultaneously affect both of the groups as they move from the before to the after period. On the second count, in order to assess whether former accident spots and the actual Silver Zone locations mutually complement each other, we use spatial statistical analyses - Kernel Density Estimation and Bivariate Local Moran’s I. The KDE method for point pattern identifies spatial clustering. Bivariate Local Moran’s I examines whether two different attributes are distributed spatially with any relationship.

From DID, we learn that Silver Zone is ineffective in reducing senior pedestrian car accidents. From Kernel Density mapping and Bivariate Moran’s I analysis, we found spatial mismatch between the frequent senior pedestrian car accidents spots and the actual locations of Silver Zones. This implies that such underperformance of the Silver Zone system could be attributed to the current protocol whereby previous accident history was not considered or at least not prioritized in zone designations. We conclude by pressing a necessity of more comprehensive master planning in operating the system at municipality level, in that local governments should take responsibility to inventory and prioritize locations vulnerable to pedestrian accidents by periodic surveys.

# Analysis of Green Walls and Roof Gardens of West Texas

**Louis Mills** Texas Tech University  
[louis.mills@ttu.edu](mailto:louis.mills@ttu.edu)

**Thayne Montague** Texas Tech University  
[thayne.montague@ttu.edu](mailto:thayne.montague@ttu.edu)

Green walls and roofs have become recently popular, spawned by an explosion of irrigation systems, plant ecology research, lighting design and need for increased storm water retention. West Texas has a number of exemplary design examples applicable to many semi-arid regions. Texas is particularly challenging from a plant selection perspective in lieu of the wide array of weather patterns. In winter, the temperature can range from high temperatures in the 60's and low 70's to 3 feet of snow and wind chill near zero. In addition the arid climate of less than 15" of rain per year, combined with the consistent wind, dust and sunshine pushes many plants to extreme survival conditions. In this respect the plant selection relative to the micro climate creating in the roof or wall design is most critical. In Lubbock, design projects promoting green architecture have been underperforming due to the plant selection, incorrect exposure and architectural context, poor irrigation, and lack of proper maintenance. A critical look at some regional examples would assist the designer in carefully setting design objectives and parameters for a successful project with healthy plants, beneficial ecological habitat and superior energy savings.

Case studies will include comparative matrix analysis of desirable traits, in some circumstances the green designs have had long term economic feasibility and energy savings audits. Using images from case studies in the Lubbock region of West Texas, a critical examination of applied horticultural and landscape architectural variables will be assessed and compared in the pursuit of quality green architecture. These examples will include built green roofs, rooftop gardens with modern kitchen designs, trellis and wall green spaces, recommended construction details and materials. Ongoing research from the Texas Tech Dept. of Plant Sciences and Landscape Architecture will be presented (both poster and lecture, through PowerPoints, will be utilized).

# Evidence-based Approaches to Medical City Master Planning in a Frontier Market: A case project in Akwa Ibom, Nigeria

**Chanam Lee, Forster Ndubisi** Texas A&M University

**Sinan Zhong, Wenyan Ji, Xue Li, Di Yang, Sungmin Lee** Texas A&M University

**Macharia Waruingi Ustawi, Isaac Amos** Thompson and Grace Investment

**Introduction:** This presentation is to explore how existing theories and empirical evidence can be used guide the development of a medical city master plan in a frontier market, using a project case in Akwa Ibom, Nigeria.

**Description:** While the Niger Delta region is known for its rich natural and ecological resources, its residents have suffered from inadequate access to healthcare. The region's infant mortality rate is among the highest in the world. According to World Bank, life expectancy of Nigerians as of 2012 was only about 52 years, compared to 79 for Americans and 75 for Chinese. Large-scale interventions like the implementation of a comprehensive medical city can respond to the urgent need to improve health and health care among this vulnerable segment of the population.

**Methods:** A qualitative approach was used to collect inductive data from several sources to cover all critical elements needed for developing a comprehensive medical city in a frontier market. Data originated from: (1) case studies of ten most relevant examples, (2) literature reviews and research on nine most relevant substantive topics, (3) in-depth interviews with the clients and stakeholders of health and human developments in Nigeria and the US, and (4) field observations to gather all necessary physical and socio-cultural data from the project site. The evidence-based design/planning approach offered a valuable framework to guide the master-planning decision-making process.

**Results:** The data gathered were synthesized and analyzed to extract most salient elements of medical city master planning, which were then categorized into 'people,' 'economy,' and 'environment.' This led to the development of three overarching guiding principles for the master planning: (1) healthy living for all, (2) economic and cultural developments, and (3) sustainable and low-impact development. In addition, eleven master plan objectives including active living, safety/security, food systems planning, economic development and education, etc., and 60 performance measures were derived from the data gathered.

The ten-month master planning process involving multidisciplinary team and advisor members resulted in a comprehensive plan that will serve as the basis for implementing the medical city within the next three years. The final Thompson & Grace Medical City master plan was developed to create a sustainable and self-contained mixed use community anchored by a world-class teaching hospital on a 100-acre green field property. It provides a full range of healthcare services, including curative and preventive cares, and traditional and alternative cares, to residents, employers and visitor. It proposed optimal spatial arrangements of diverse land uses including an urban center, hotel, conference center, diverse residential communities, artisan village, entertainment center, elementary school, and industrial park. The City's land uses are supported by multi-modal transportation systems and extensive green infrastructure, while responding to the local history, culture and landscape. It was prepared to serve a model for future healthcare development in Africa and other frontier markets.

**Conclusion:** This project offers theoretical and practical insights into the design, planning, and implementation processes for developing healthcare projects and communities in a frontier market.

# The Restructuring of Public Space: The Tabula Rasa Transformation of the Ithaca Commons

**Judith Wasserman** University of Georgia  
[judithw@uga.edu](mailto:judithw@uga.edu)

**Paula Horrigan** Cornell University  
[phh3@cornell.edu](mailto:phh3@cornell.edu)

This paper asks what design knowledge can be drawn from a case study comparison of the “old” (1974) and “new” (2015) designs of the Ithaca Commons Ithaca, New York’s pedestrianized downtown mall. The “commons” is spatially articulated as a public venue for discussion, trade, ritual and performance. As Ithaca’s antidote to the decline of the urban core from suburbanized shopping, the Ithaca Commons was designed both with a community ideology reflective of the times, as well as an attempt to forestall the decline of the downtown business district.

Opened in 1974, the Ithaca Commons has remained a pedestrianized downtown environment. Through annual programmed events, the Commons has become a downtown landmark and defines Ithaca’s sense of place. While the “Commons” endures, its original 1974 design does not. In the early 2000’s decaying infrastructure and piecemeal adaptations were compounding. While the original design initially fostered economic vitality, the stores eventually began a renewed decline. Concerns that the “undesirables” inhabited the highly variegated social spaces were regarded as a negative result of the designed form. The decision was made to demolish the “old” and begin anew.

The functional modernist aesthetic of the original commons emphasized sociability through creating an interconnected set of outdoor rooms. These spaces, articulated through plantings, architectural or tree-canopied roofs, angled walls, and level changes, were conducive to performance, gatherings and meetings, children’s play, and informal games. In contrast, the 2015 Commons, by Sasaki and Associates, took an opposite approach. The complexity has been replaced by simplicity. Experiential diversity has become a flat, uninterrupted, street-like plane. Gone are the protective overhead structures. The entire space is visible from a few vantage points, spaces are “branded”, and surveillance cameras are starkly visible.

The Commons transformation is examined through a case study comparison using Thompson’s 3-part design values framework (Thompson, 2002) of ecology, community and delight, as one of its critical lenses. A second critical lens is the construct of place being embodied and produced in the Commons’ old and new designs (Cresswell, 2004). The authors compare the transformation through archival research to determine design intent, and written, visual and graphic analysis of the two design visions. The findings discern what design and social values are reflected in the spaces, the experiential differences, and how the aesthetic transformation is a commentary on contemporary social values.



# Data-Driven Design Process for Smart Cities

**Saleh Kalantari** Washington State University  
[saleh.kalantari@wsu.edu](mailto:saleh.kalantari@wsu.edu)

**Steve Austin** Washington State University  
[steve.austin@wsu.edu](mailto:steve.austin@wsu.edu)

**Darrin Griechen** Washington State University  
[dgriechen@wsu.edu](mailto:dgriechen@wsu.edu)

**Judy Theodorson** Washington State University  
[jtheodorson@wsu.edu](mailto:jtheodorson@wsu.edu)

Advancements in the fields of information and communication technology have created a new era for the urban environment. By collecting, monitoring, and parsing an endless stream of data, smart cities promise to continually evolve, catering more effectively to the needs of their inhabitants (Harrison et al., 2010; Batty et al., 2012). While research related to smart cities is becoming increasingly abundant, research on the data-driven design approach to smart city architecture is still in its infancy. The core question of this research is how designers can influence the paradigm of smart cities by putting an emphasis on data-driven design processes. Spokane, Washington's Smart City Accelerator Group, which includes Washington State University's School of Design + Construction, is researching how to incorporate smart city technologies in Spokane's University District. Through the Integrated Design Research (IDR) Studios at WSU, researchers are experimenting with different methods across multiple disciplines to determine what mechanisms can be used to best create cities that monitor, analyze, and utilize data to improve infrastructure, security, and social and economic services for their inhabitants. Students in the fields of architecture, interior design, and landscape architecture are incorporating research-based, data-driven design solutions to confront current and future needs that can be addressed through the built environment. Researchers at IDR Studios evaluate smart cities through four main categories: Human Interaction, Urban Metabolism, Health and Well-Being, and Urban Ecotones. By examining Human Interaction with natural, technological, social, and built environments, researchers aim to create a city whose infrastructure, services, and systems cater specifically to the individuals living in that particular location. A city's Urban Metabolism is the interaction of resources, materials, and people that researchers hope to shape into more efficiently functioning system. Technologies may also be utilized to improve Health and Well-Being in a city, by providing opportunities and services that more effectively respond to and influence people's behaviors. Finally, Urban Ecotones are areas in the city that are separated by existing conditions—either physical or social. By data-mapping the Spokane University District's existing conditions and health indicators, researchers at IDR Studios are using solid empirical data to develop design solutions that will improve the area's welfare, social health, and community engagement. It is anticipated that this work can help to create a paradigm shift in the mindsets of the city's inhabitants, bringing the city of Spokane closer to achieving its goal of becoming a technologically advanced, human-centric smart city.

# An Urban River Park Vitalizing New City Development - Applying “Shan-shui City” Concept into the Landscape Planning and Design of Yulong Park in the New City of Fuxin

**Jie HU** Beijing Tsinghua Tongheng Urban Planning & Design Institute  
[tsinghuala@gmail.com](mailto:tsinghuala@gmail.com)

Urbanization has brought many advantages to human beings, but it also brought a series of ecological environmental problems at the same time, such as deterioration of natural ecological system, fragmentation of habitats and environmental pollution, etc. Studies on river ecological systems cannot be isolated from their evolutionary context. Almost a century's worth of global economic development, population increase, environmental pollution and urbanization have greatly changed the characteristics of original rivers. Statistics shows about 60% of rivers in the world have been artificially modified, including dam and embankment constructions as well as river reformations (Brookes & Shields 2001). In China, most rivers have more or less been developed or utilized, except for a few big rivers in the remote areas of southwestern and northeastern China. Inspired by traditional Chinese Shan-shui City concept, the objective of this project is to find applicable approaches for most cities in China that are undergoing rapid urbanization with modified river context; from a practical perspective the current challenges include dealing with artificial canalization and insufficient water discharge due to improper water usage. Yulong Park is a pilot project for Fuxin City providing a good opportunity in urban spatial development, while meeting different demands from local residents, building upon the traditional urban context and enhancing urban functions. It has directly improved quality of life in Fuxin city, increasing the quality of life index of local residents and playing a profound role in the sustainable development of the new city.

## DILEMMA : DEBATE THEME TRACK



# Landworks-Sardinia: Post-Industrial Experiential Design

**Simon M. Bussiere** Ball State University

**Kera Lovell** Purdue University

Mining is a pressing global problem. With operations on nearly every continent concentrated in impoverished communities, mining remains not only a perilous occupation but also a detriment to communities and the environment. A 2005 EPA report cited more than 500,000 abandoned mines in the United States alone (EPA 542-R-05-030, 2005). Resource extraction exerts enormous long-term environmental impacts on the planet, including a sensory overload of pollutants that negatively alter landscapes and communities visually, aurally, and odorously.

While landscape architects are rarely involved in the origins of mining operations, professionals and students are deeply involved in the redevelopment of brownfields. (Kirkwood, 2001; Aasen, 2012). Through reclamation-based design principles, landscape architects are strategically poised to remediate contaminated soils (and communities) and adaptively reuse existing structures and landscapes. Landworks (LW) is one organization on the leading edge of this issue. LW annually brings together practitioners and students from across the globe to engage with remote/sensitive landscapes and to problematize the current and future standing of mining brownfields. This is done through the production of in-situ installations over a 10-day period that highlights key cultural, ecological and economic factors, inciting debate about the nature of both existing conditions and potential future directions.

This paper argues that Landworks is a constructive experiential learning tool for design students to problematize and reimagine post-industrial landscapes. The authors present the 2015 version of Landworks, set in the abandoned silver mines of Argentiera, Sardinia to elucidate their intensive process of experiential design. Beginning with critical site-analysis, Landworks participants uncover the site's "working traces," or the layered physical marks made by human hands on the land over time (Bargmann, 2014). Through forensic scrutiny, students excavate and evidence the multi-layered indexes of that past by revealing inconspicuous and otherwise hidden layers that are inextricably integrated into the landscape. These factors become the creative drivers that propel team-based site-specific installations that are presented to community members, local politicians, and environmental advocates. While a purist historic-preservation approach would, at times, design a solution nostalgically based on a frozen moment of time, the intention at the core of each Landworks workshop is to rejoin the conflicting forces of old and new at work on a fallow and latent landscape. The process amplifies the dialectic between both culture and environment as dynamic systems and frameworks for the continuous process of regeneration.

# Examples of Adapted Ethnographic Approaches for Participatory Design

**Katie Kingery-Page, Abigail Glastetter, Danielle DeOrsey, Jessica Falcone**  
Kansas State University

My students, colleagues, and I work with urban communities on everyday landscapes such as streetscapes. Our goal is to help our community partners build landscapes that are imageable, poetic, and durable. We seek to amplify place meaning—the type of pluralistic meaning described by Edward Relph through the qualities of “generosity and imperfection” (Relph 1999 26). “Whose meaning?” becomes an important question, though not easily answered.

In participatory processes co-organized with a client or community partner, landscape architects typically defer to the partner to invite community members to meetings and workshops. Our partners usually represent some codification of power in the community, whether as an individual leader, organized community group, or incorporated non-profit organization. Ethically, we must respect our partner’s authority while also gently questioning the partner’s notion of “who belongs” in the decision-making and design process. Ethnography’s intent of providing a place-based understanding of culture or sub-culture reminds us to broaden the sample of whose input is sampled (and provides a structure for doing so) and to rigorously analyze that input before interpreting its meaning for design.

To expand inclusion in the design process, we propose using adapted ethnographic methods such as one-on-one interviews using a snowball sample and observation. Interviewing and observation are “classic techniques” of ethnography (Whitehead 2005). However, in projects lasting a year or less, we cannot produce a true ethnography, or “...interpretive story, reconstruction, or a narrative about a group of people” (LeCompte and Schensul 1999, 4). Developing such a narrative is a deep and long term endeavor, often occupying the majority of an ethnographer’s career. To adapt ethnographic methods for use during a relatively short period of time, a spatial designer must limit the inquiry to a specific “lens” or particular question related to the community design at hand (after LeCompte and Schensul 1999, 4).

Recently, we used an adapted ethnographic approach in the design process for a temporary park on private, downtown property in a Midwestern city of less than half million residents. Our partner is a not-for-profit development corporation. Through careful content analysis of a series of resident interviews, one student advanced the residents’ desires, which initially seemed at odds with the property owner’s desires, and the park is currently in construction. Another student used a digital variation of participant-observation by video-recording the experiences of bicyclist in the city’s downtown near the park site.

The benefit of adapted ethnography is that it gives us first-person accounts of a place and of people’s needs. However, short term use of ethnographic approaches also has limitations. We have focused narrowly upon physical settings and needs, rather than carefully investigating the entire cultural system of a place. In terms of application to participatory design, the rigorous content analysis of adapted ethnography may be criticized as time-consuming.

Group meetings for community projects, like workshops and charrettes, can yield important results, especially in allowing people to learn “who [their] neighbors are” (Hester 1989 74). However,

[please contact author for remainder of abstract]

# Airports As Resilient Reserves

**Sara Favargiotti** University of Genoa, Italy  
[sarafava@yahoo.it](mailto:sarafava@yahoo.it)

What do huge flocks of sheep, hundreds of rabbits, business parks, metropolitan parks, leisure parks, high-tech parks have in common with airports? These are the most frequent visitors to airports recently constructed in Europe. These are the new ways of inhabiting an airport and connecting it to its context. In fact, having so many airport infrastructures has caused a premature obsolescence of many of them. Many airports were abandoned becoming a problem for cities in terms of space and cost. This creates, among other consequences, many brownfields. The dilemma is urgent. However, airports are challenging case studies because they are very difficult to try to put back into the old structure of the city. The combination of centrality, emptiness, environmental contamination and economic capability makes a good case for study from a landscape perspective. How should our disciplines deal with these complex urban elements?

Many abandoned airports have already been redeveloped as a new part of the city. Orange County Great Park (Irvine, California), Crissy Field (San Francisco), Maurice Rose Airfield (Frankfurt, Germany), Tempelhofer Park (Berlin, Germany) are few of the numerous projects that show the reconversion of an existing airfield into a new part of the city: a re-naturalized park providing new economic and social activities (like re-naturalization, park facilities and temporary installations). Generally, the growing population, the high demand for new dwellings or their physical centrality in the city simplify their reconversion in new urban developments or urban parks. To view the airport as something that can be reloaded means to consider its rhythms, its life cycle, and its metamorphoses. These re-interpretations of the airport landscape allow us to conceive the airport not only as transport infrastructure but also as natural reserves for city developments or as spaces for landscape reclamation. Accordingly, airports may become new urban resources, improving the quality of urban life and becoming a place to live before a place to leave.

The paper aims to offer the documented registration of a phenomenon in progress. Airports today, have never been more central to the life in cities, yet they remain peripheral to many discussions in urban design and planning. According to Charles Waldheim, describing an airport as a landscape is already an important conceptual break through: just claiming it as a landscape, not just as a simple engineering or architectural project, but within a more coherent framework. In that sense, airports can be kept as reserves for cities. Some destinies may be opened and they generate unexpected uses with an urban approach toward resilient infrastructures. These resilient reserves aim to anticipate the future and adapt to its unpredictable environmental, cultural, social and economic changes.

# What Use is Research, and for Whom?

**Marc Treib** University of California, Berkeley

To an ever increasing degree “research,” i.e., academic publication, is determining advancement, departmental budgets, and more sadly, personal interests. This paper plays devil’s advocate, and questions the idea whether research is a crucial activity for everyone. The paper is based years of readings in academic journals, teaching, visits to numerous schools in the U.S. and abroad, and discussions with students and faculty. It questions both the validity of much, but certainly not all, research, and whether only publications should be regarded as acceptable production.

Seven points, questioning both substantiation and method, inform this challenge: a) researchers often regard as constants factors an informed designer knows to be variables (i.e., the use of photographs as a transparent medium for landscape assessment); b) the questionable attempt to quantify qualitative—and contingent—factors and experience (social sciences as the dominant model for design research); c) the dissolution of validity in the transfer of findings from laboratory research (where constraints can be limited and controlled) when introduced into the real world; d) the notion that “peer review” establishes the only desirable academic standard (where usually only two or three “peers” are involved, often with a vested interest in the subject pro or con); e) for what and whose use is this research (often only that of other researchers); f) much research is merely the testing and packaging of common sense and thus needed only as a “make work” project for academics; and g) that research is more valuable than findings derived from design practice (as authors Deming and Swaffield are exceptions to the rule).

An ever-growing number of schools now stress publication over design or other creative achievement. In the UK, a PhD is required now for almost every academic position, when one could argue that additional practice would be more valuable for those teaching design. Rather than more research valuable to only few people, I would propose a more inclusive studio education, integrating research as deemed useful. “Evidence Based Design” need never have existed. Any thoughtful designer would have studied past projects, spent time on site, spoken with the client group, etc. What we find here, as in so many “scholarly projects,” is the theorization of informed common sense that reinforces the overarching problems: 1) the sciences being used as a model for the humanities (in which I include the design disciplines); and that 2) academia operates as a reincarnation of the medieval guild system, increasing turning more and more inward upon itself.

# Dilemma: Leveling the Playing Field in Higher Education Between Scholars of Teaching and Scholars of Research Using SoTL

## Debate: The Benefit-Costs of SoTL in Higher Education Today... and Its Potential Impact on Landscape Architecture Tomorrow

**Joanne Westphal** Michigan State University  
[westphal@msu.edu](mailto:westphal@msu.edu)

The Scholarship of Teaching and Learning (SoTL) is not a new concept, but its use is broadening and gaining traction as a pivotal point in discussions affecting faculty merit, promotion, and/or tenure in higher education. In this study, the authors examine the evolution of SoTL as a teaching tool (Boyer 1990; Kremer 1990; Johnson and Ryan 2000; Centra 2000), and how it is evolving as an evaluative tool in decisions affecting faculty performance (Root 1987; Lattuca and Domagal-Goldman 2007; Cohen and McKeachie 2008).

To document SoTL's evolving role, the research team examined websites of twenty-one major Land Grant Universities with Colleges of Agriculture across the US. The purpose was to gather baseline information on policies, practices, and standards surrounding faculty performance evaluations. The online search was followed by personal interviews of eleven deans from ten of the 21 universities. All the deans interviewed, had primary responsibilities for undergraduate education and faculty performance in their respective colleges. The interview addressed three questions: 1) was SoTL a viable concept within the merit and tenure system at their institution, and if so, how was it operationalized by the administration; 2) did administrators view SoTL as a means to insure balance among competing interests relative to teaching, research, and outreach/service employment assignments; and 3) how was SoTL integrated into traditional university evaluation processes where heavy emphasis on research often occurs at the expense of teaching and outreach productivity?

Our online research search (including faculty handbooks) of university policies relating to faculty work assignments revealed almost no information on specific standards, or criteria used for evaluating faculty performance. Websites of Colleges of Agriculture fared slightly better, with about half of the 21 Colleges actually outlining "general expectations" for faculty in teaching, research, & outreach, respectively. Interviews of the deans were the most informative. Almost all discussions focused on strategies used to change internal work conditions that would "level the playing field" among researchers, extension personnel, and teachers. In some cases, this involved modifications in teaching assignments; contact hours related to subject matter; student evaluation reviews (SERs); and the use of SoTL in course output. The practical aspects of incorporating SoTL into existing evaluation systems often followed. Pro arguments included perceptions of social justice, administrative aspirations, and needs to "re-balance" evaluation systems that overemphasize research outputs and SERs. Barriers included institutional inertia, faculty workloads, and lack of "on-site evaluative expertise". These findings, and others, will be summarized and discussed.



# Justice as Justification for Design

**Hyejung Chang** Clemson University

Ever since the profession of landscape architects began to shift away from ‘garden-making for the elite’ and increasingly expanded its realms of responsibility from private to public tasks, a growing interest in social and environmental issues has guided its protagonists to develop and apply rational, democratic, and moral principles to design. Environmental justice, however, has not been a similarly strong driving force within the conventional practice of landscape architecture; on the contrary, it has often been ignored or marginalized.

While justice has recently been receiving more attention within the profession, pursuing it still remains problematic for landscape architects for many reasons: 1) There is difficulty in understanding the issues of environmental justice within the contexts of both professional and philosophical approaches to ethics (Rolston 1988); 2) Moral intentions and consequences are often not sufficiently reflected in our common actions of everyday life; 3) Landscape architecture often tends to dismiss holistic reflection on ethical judgments outside the scope of a narrowly defined discipline; 4) There is confusion about how the issues of justice fit within the core values of democracy.

This paper will respond to the above issues. First, it will briefly introduce justice as a core value in the practice of landscape architecture. It argues that justice is a primary principle to make a valid argument for, and an ideal judgment about right and wrong, and that it is an important criterion for evaluating competing ethical principles in environmental design (Regan 1993). Second, it will provide the practical context of justice by arguing that justice constitutes our ‘common integrative sense’ of design as the “old ways of thinking” (James 2007) for problem-solving and place-making. Finally, it will propose a conceptual framework to discuss how justice relates to the notions of democracy, participation, public value, and moral obligation that are mutually supporting in theory, yet often disjointed in practice.

In conclusion, the paper aims to offer a conceptually clearer and methodologically more useful framework to the practice of landscape architecture as our profession seeks to promote the driving force for environmental justice more actively. The hope is that it will prompt us to think about what is ‘just and right’ in facing difficulties in making our public environment, to share a sense of justice as a public sentiment, and to participate in open debates on the profession’s role in establishing a just democratic society (Rawls 1971).

# Can Discussion Replace Face-to-Face Interaction in Effective Online Design Education?

**Caren Yglesias** Academy of Art University

[caren.yglesias@gmail.com](mailto:caren.yglesias@gmail.com)

**Heather Clendenin** Academy of Art University

[Hclendenin@academyart.edu](mailto:Hclendenin@academyart.edu)

The role of technology as an integral part or replacing the more traditional aspects of design education has been a contested subject for several decades. Recently, and more specifically, the value of online education for landscape architecture has generated debate. Is it a fad turning education into entertainment that appeals to Millennials, the so-called iGeneration who are digital social media experts? Can it deliver the rigorous education needed by an evolving profession that demands creativity and technical proficiency? This paper critically reviews research on and best-practices of asynchronous online design education in a distributed learning environment, and argues that it can assure enriched discussions suitable for design inquiry, and further, that this flexible and responsive model is compatible with emerging global professional practice and continuing education trends, which are increasingly conducted online.

Unlike free MOOCs or one-directional webcasts, that sometimes have a brief question and answer period, students enrolled in online programs pay tuition to take courses in a curriculum that leads toward a degree. Current research concludes that effective online courses require significant discussion between professor and student, and among students, which is especially appropriate for landscape architecture design classes. This paper focuses on one particular problem with this requirement, as noted by Rennie and Morrison, where students may not understand enough of the course content to participate in productive discussions, unless closely guided by the professor.

For example, the Academy of Art University began its online education program in 2002. Nine years later, the School of Landscape Architecture began offering online versions of their onsite courses, which when complete, will be the first entirely online first professional graduate and undergraduate degrees. An extensive Online Education Department supports this work. This presentation will include finding of research conducted by the university as well as external sources that evaluate the effectiveness of discussion-promoting educational techniques for online as compared to face-to-face teaching. Further, this presentation includes ASLA professional global practice trend data as it supports an argument for the benefits of online education for landscape architecture students who learn to successfully navigate and develop online communicative skills. It suggests that these graduates may be better prepared for global practice.

# Making Room for Risk in Play Environments and Play Standards

**Daniel Jost** North Carolina State University  
[djost.1983@gmail.com](mailto:djost.1983@gmail.com) or [dcjost@ncsu.edu](mailto:dcjost@ncsu.edu)

**Bambi Yost** Iowa State University  
[byost@iastate.edu](mailto:byost@iastate.edu)

**Shannon Miko Mikus** University of Georgia  
[mikozilla@earthlink.net](mailto:mikozilla@earthlink.net)

**Mohsen Ghiasi Ghorveh** North Carolina State University  
[mghiasi@ncsu.edu](mailto:mghiasi@ncsu.edu)

Over the past few decades, concerns about safety and liability have led to the elimination of any features considered to be risky from many play environments. This panel will explore the current debate over rethinking American playground standards to allow for beneficial risks.

Panelists have conducted a literature review to understand how concerns about safety have led to the removal of play features associated with risk over time and the potential consequences of removing risk from play environments. Research suggests that certain types of risk-taking can have developmental benefits. Panelists will look specifically at a few types of play features (trampolines, stormwater features, etc) that are strongly discouraged by local or national playground standards, regulations, and guidelines. They will review research related to the developmental benefits offered by these features and the safety hazards that may be posed by these features. Data from the Consumer Product Safety Commission's National Electronic Injury Surveillance System related to these features will be analyzed, the limits of this data will be highlighted, and the need for improved data collection to inform debates in the U.S. will be discussed. A limited number of case studies will show how some designers have designed out hazards associated with these features while preserving the developmental benefits.

There have been a few recent efforts to rethink playground guidelines and standards to encourage risk taking--both by the designers and users of spaces--and we will discuss some of these approaches, their strengths, as well as dilemmas they present. For example, current efforts to refocus standards on surfacing, meant to prevent the most serious injuries from falls, might allow for greater creativity and risk-taking in equipment design. Yet, some research has suggested there will be financial costs associated with such regulation and there may be developmental costs and new hazards created if such regulations lead to the closing of playgrounds.

A primary purpose of the panel is to identify research opportunities for academics within the landscape architecture field to contribute to the conversation on balancing risk and safety on playgrounds by identifying specific gaps in the research. Opportunities for encouraging understanding through studio projects will also be discussed. A case study will suggest how schoolyard design might be addressed in a studio setting in a way that encourages creative thinking, an understanding of financial realities, and the limitations posed by existing standards.

# Siting the Past/Projecting the Future: Public Debate and Richmond's Landscape of Memory

**C.L. Bohannon** Virginia Tech  
[cbohanno@vt.edu](mailto:cbohanno@vt.edu)

**Brian Katen** Virginia Tech  
[bkaten@vt.edu](mailto:bkaten@vt.edu)

David Buege has recognized that “after language, landscape is the fundamental medium of American public, and therefore popular, discourse.” This centrality of landscape in our collective imagination has never been more evident than in today’s ongoing American debate regarding Confederate memorials, monuments to the Lost Cause, and the public display of the Confederate Battle Flag. Fundamental, reflective questions of propriety and the appropriateness of these symbols in their respective landscape settings are the focus of public discussions throughout the country. The presence of these highly charged symbols in shared landscape settings, characterized by one editorialist as “instruments of racial terror,” pose a significant dilemma for individuals and public and private institutions alike.

Removal from the public realm of these symbols of the Confederacy and the recognition of those who served the Confederacy has been one proposed solution to this dilemma. But the multiple discourses and perspectives that are propelling public debate challenge simple, expedient solutions. How then to acknowledge the extraordinarily complex history of these cultural symbols and the conflicting readings of the past and aspirations for a collective future embedded within them. What do we need to understand and what constructive dialogues can emerge from our understandings to inform potential resolutions to the dilemma posed by these divisive symbols?

This paper focuses upon the study of the civic, memorial landscape of Richmond, Virginia. Richmond, the capital of the Confederacy and the capital of today’s vibrant Commonwealth, provides a unique laboratory for the study and understanding of the genesis and evolution of America’s commemorative landscape of the Civil War. Here, Civil War memorials and monuments became a central element in the creation, organization, and evolution of the city’s civic infrastructure – an infrastructure that has begun to demonstrate a remarkable and, at times, contested transformation in recognition of past injustices, long-standing grievances, and ever-evolving values. Might the continued transformation of Richmond’s landscape of memory inspire new discussions and negotiations- an unending dialogue that values the complexity of collective memory and varied perspectives and interpretations to provide a deeper understanding of our shared history and collective future?

Through the use of qualitative methods including discourse analysis of period and contemporary published sources and coverage in Richmond’s white and black press, deep mapping, and analytical mapping using GIS, a more complete understanding of the consequences of removal or retention of these powerful symbols in a multicultural city of the 21<sup>st</sup> century will emerge.

# Terra Interra

**Katherine Jenkins** Cornell University  
[kj257@cornell.edu](mailto:kj257@cornell.edu)

**Parker Sutton**  
[parker.sutton@gmail.com](mailto:parker.sutton@gmail.com)

Over the last quarter century, American municipalities have observed a collapse in the system of landfills that manage our waste. Small to mid-size landfills that once serviced local townships are, in effect, extinct: victims of ever more stringent and costly regulations, including but not limited to the Resource and Conservation Recovery Act of 1976<sup>1</sup> and the Solid Waste Management Act of 1988<sup>2</sup>. Such regulations demand that waste processing facilities operate at scale to survive. As a consequence, landfills are closing and consolidating. From 1986 to 2009, the number of domestic landfills decreased from 7,683 to 1,908<sup>3</sup>. Wittingly or not, advancing regulatory norms have given rise to manufactured landforms - ersatz mountains - of unequalled scale.

How, as architects and landscape architects, might we reckon with this new geography of waste? The implications of this shift raise spatial provocations with regard to logistics - waste is now traveling farther than ever before, increasing its carbon-footprint - and form - landfill structures are often the tallest structures in their immediate environment, impossible to see all at once yet visible for miles.<sup>4</sup>

With the staggering quantity of material entering a present-day landfill - upwards of 6,000 tons daily at Seneca Meadows, New York state's largest active waste-management facility - they are pregnant with as-yet unimagined design potential.<sup>5</sup> The afterlife of any landfill far exceeds its active period. Yet, efficient design privileges a landfill's comparatively brief period of construction. It is increasingly worth asking, given the heretofore unseen opportunities for earth-molding that modern landfills present, what new morphologies might emerge if landscape architects designed waste-sites from nascency? How can landscape architects reshape landfill construction to create a more culturally resonant and aesthetically-minded terrain?

Landfills posit singular design challenges: they are at once highly visible (often the most prominent topographic feature in the landscape) and completely invisible (with regard to their contents and processes); they exhibit binary time scales (human-scale in their construction, geologic-scale in their decomposition); they are burial grounds without ceremony. Through an analysis of existing landfill-parks, this paper presents an index of case studies that illustrate the constraints inherent to transforming landfills into public space.

The paper concludes with a series of hypothetical design solutions that utilize waste as a building material. The proposed landfill morphologies express the unique ecological, aesthetic, and recreational opportunities achievable outside of the current trajectory of landfill construction and decommission.

# Debate, Dilemma & Accountability: Revisiting Values in Landscape Architecture & Environmental Design

**M. Elen Deming** University of Illinois  
[medeming@illinois.edu](mailto:medeming@illinois.edu)

**Kyle D. Brown** California State Polytechnic University at Pomona  
[kdbrown@cpp.edu](mailto:kdbrown@cpp.edu)

**Martin Holland** Clemson University  
[mjholla@clemson.edu](mailto:mjholla@clemson.edu)

**Catherine Seavitt Nordenson** City College of New York  
[cseavittnordenson@ccny.cuny.edu](mailto:cseavittnordenson@ccny.cuny.edu)

Conflicting values in social, cultural, and environmental realms can set in motion a series of practical and moral impasses. A series of debatable values were recently published as *Values in Landscape Architecture and Environmental Design* (LSU Press, October 2015). This panel expands upon three case studies from that book in order to update and assess the impact of situational decisions that continue to unfold. Four panelists include a moderator and three original contributors to the published volume. The moderator [M. Elen Deming] opens the session with a brief overview of the edited volume, survey of the issues of debate, dilemma, and accountability in environmental design values, and then introduces the panelists.

Panelist Kyle Brown discusses a double dilemma in community engagement and service learning programs. When coming from a background of privilege, some students find it difficult to relate to social and economic hardship; also, as part of their professional education, many students are instilled with an “expert” mindset that challenges their effectiveness as facilitators. Brown presents a focused case study in community action research in which educators use emerging techniques to counteract cultural bias in young investigators and problem-solvers.

Panelist Martin Holland examines the dilemma of public participation within memorial design competitions. Commemorative spaces function as “public objects” that “help entire communities mourn a loss by offering settings for ceremonies and rituals” (Wasserman, 2002). At the Oklahoma City Federal Building Memorial, dilemmas arise when changes in public opinion effect the commemorative environment as built, in particular when a “conscience committee” of those directly affected by the bombing serve as the competition jury. Twenty years after the Oklahoma City bombing, new debates arise over how to interpret the bomber in the memorial museum.

Panelist Catherine Seavitt Nordenson examines debates arising from genetic manipulation in erstwhile nature preserves. Dilemmas abound in the continuing “re-wilding” movement and the implications of land management to support them. Several attempts at reconstructing extinct species (such as the mammoth and the passenger pigeon) are advancing even as we continue to extirpate hundreds of other species as part of our Anthropocene “sixth extinction.” Using Aldo Leopold’s concept of the “Land Ethic,” the fate of such experiments is critiqued.

At the conclusion of prepared remarks, the moderator will facilitate an open discussion about how the mission, practices, and responsibilities of landscape architects and educators are implicated in “debatable” design practices and processes.

# Beating the Property Barrier: Building Community to Build Ecology in Cities

**Joshua F. Cerra** Cornell University  
[jfc299@cornell.edu](mailto:jfc299@cornell.edu)

**Rhiannon L. Crain** Cornell University  
[rlc273@cornell.edu](mailto:rlc273@cornell.edu)

As urban populations continue to rise many cities are under increasing pressure to maintain crucial ecosystem services with limited public open space. Residential landscapes in the form of gardens, lawns and other greenspaces however can occupy approximately a quarter of the urban land base (Loram et al., 2007). Cities are facing a dilemma: with limited public property available, how might they best engage private landowners in improving their own landscape performance?

Strategies for catalyzing urban ecological stewardship on private property are emerging globally (Cerra, 2014). Recent studies suggest that directly engaging landowners can be effective in encouraging them to enhance their properties for urban habitat benefits (van Heezik et al., 2012, Goddard et al., 2013). Can a combined process of community visioning and site-by-site design amplify landowner motivations for change? This paper discusses a three-year studio effort conducted in cooperation with Cornell Lab of Ornithology's YardMap program and Cornell Cooperative Extension. Each of the three participating communities had different primary drivers for participation including urban habitat enhancement, water quality and climate adaptation. First the studio team worked with community members to develop a neighborhood-level vision and goals. Each student then worked with an individual landowner to design their property in a way that met community goals while also satisfying landowner preferences and aesthetic interests. Students also calculated the potential environmental benefits of the over 50 site-by-site designs developed for the project. Hands-on "client" engagement significantly influenced student design decisions as they navigated tensions between environmental performance and residential aesthetics.

Landowners expressed satisfaction with the results of the team's community process and the design process with their student designer. 75% of survey respondents indicated that their individual interests were heard and reflected in the community approach "often," "most of the time" or "all of the time." 70% or more of respondents selected "definitely true" or "probably true" when rating whether their design is "just what I need" to a) start creating habitat; b) be a better watershed steward; or c) better adapt to a changing climate on their property when these statements were consistent with the neighborhood-level goals. While few respondents indicated they will implement all of their property's design, 70% said they were likely or very likely to implement some of it. Ongoing installation of the designs is also described as an indication of how engaged, design-based stewardship strategies may inspire collaboration and change landscapes for the benefit of cities.



# Navigating an Epistemological Turn toward Democratic Design

**Paula Horrigan** Cornell University  
[p hh3@cornell.edu](mailto:p hh3@cornell.edu)

**Mallika Bose** Pennsylvania State University  
[mub13@psu.edu](mailto:mub13@psu.edu)

Since the 1960's, landscape architecture and its sister professions have been evolving and transforming in sync with a world where diversity, human and civil rights, equity, environmental justice and democracy are on the rise. They have been steered toward greater inclusion of users and stakeholders in design and planning processes by federal legislation, regulations and policies. In academia and practice, key individuals, institutions and groups have collectively emerged democratic participatory community design theory, methods and practices (Hester, 1990; Sanoff, 1990) and set in motion a democratic design discourse foregrounding design's social, democratic and public purposes. That discourse has been further fueled by public interest and social activist design (Abendroth & Bell, 2015) along with landscape democracy, ecological democracy (Hester, 2006) and the right to the city (Mitchell, 2003). And in higher education transformative democratic civic engagement pedagogies have played their part in fostering the interrelationship between democracy and design (Bose et al, 2014).

Developments like these affirm that democracy is growing more central to the teaching and practice of landscape architecture. They further suggest that a significant epistemological shift towards democratic design, in design education and practice, may indeed be underway. But how did we arrive at this threshold where democratic design is becoming a focal concern? What exactly constitutes and frames democratic design knowledge? From what origins and pathways does democratic design originate and along what pathways does it flow?

This presentation sets out to address these questions and to map and chart "democratic design" as a body of knowledge comprised of informing theories, practices and methods along with societal forces (legislation, movements, mandates), people (educators, practitioners), literature (pivotal texts, publications, etc.) and projects (built works, processes, etc.). The genesis of this research was a 2014 Imagining America workshop in which the authors engaged a group of democratic designers in charting the democratic design movement's shared history. A democratic design intensive at EDRA46Los Angeles not only offered the authors a chance to preview their emerging map but also affirmed the map's potential value and use. At CELA 2016, the author's will share the most current "map" and invite the audience to participate directly in its interrogation, debate and discussion and, in so doing, to collectively continue to chart the genealogy— past, present and future— of democratic design.



# INTO THE ANTHROPOCENE: A Provocation for 21<sup>st</sup> Century Landscape Architecture

**Matthew Tucker** University of Minnesota

Our future generation of landscape architects will inherit a world unprecedented in known human history. It will be a generation born into the new Anthropocene epoch with complex issues of climate change, sea level rise, food and water scarcity, mass extinctions, environmental justice, and others. Landscape architects are not insulated from these issues as some have claimed that the state of our global socio-ecological challenges are a consequence of the design profession's activities (Wu and Wu 2013). This world of pervasive human influence across all scales of the global landscape presents the central dilemma for the 21st century. In just over a decade the emerging Anthropocene paradigm-and recognition of the extent of human influence on Earth Systems-has catalyzed transformations in scientific and humanistic discourse. In the sciences, these transformations advance our ability to measure complex systems and forecast environmental change with disturbing results (Steffen, et al. 2011). Similar transformations have occurred in the humanities, such as further rupture of socio-cultural binaries while exploring new conceptual frameworks of socio-ecological relations through the concepts found in anthromes (Ellis, et al. 2010), hyperobjects (Morton 2013), manufactured ecologies and post-environmentalism (Wapner 2010). Central to such interdisciplinary concerns is the upheaval of the prevailing notion of nature and culture as essential counterparts, but ultimately separable.

Since its inception, landscape architecture has echoed and reciprocated principal socio-cultural attitudes and their shifts across time. However, ubiquitous socio-ecological issues disrupt the concept of human-environment relations and the nature: culture binary that has largely provided a foundation for landscape architecture discourse. Paradigm shifts now expose questions that challenge the validity of current knowledge and skills while also accelerating alternative and undiscovered modes of practice. However, to date no meaningful discussion within the discipline that situates landscape architecture within the Anthropocene has occurred. As a case in point, this abstract alone presents more "Anthropocene" keyword references than the total keyword references (four)\* in all previous CELA proceedings and abstracts.

If the Anthropocene paradigm presents a fundamental shift in human-environment relations, then our discipline and profession must seek a new discourse relative to this shift. To assert timely relevancy, we must begin by opening a 21st century debate into the question: what is the potential impact of the Anthropocene paradigm on the future of landscape architecture education and practice? In response, this paper provides a formal invitation for landscape architecture discourse to expand into the Anthropocene paradigm. The first portion of the paper provides a summary of the nascent Anthropocene discourse from multidisciplinary perspectives. The second portion of the paper provokes necessary renovations to landscape architectural pedagogy and practice as situated within the Anthropocene paradigm. Some renovations are underway, including landscape performance quantification research and instruction of evidence-based design; newfound landscape architectural agency in urban resilience infrastructure planning, or efforts to re-imagine the future metabolic city. Other renovations are on the horizon, including responses to the robust science of novel ecosystems and feral ecologies; exploration of waste-to-resource extractive processes such as phtyo-technologies; projective design strategies for the manufactured ecologies found within the dredge cycle; reimaged environmental politics and abundant futures; and the emergence of a [please contact author for remainder of abstract]

# Black Lives Matter: Design's Response to the Disenfranchised?

**M. Margaret Bryant** SUNY ESF  
[mbryant@esf.edu](mailto:mbryant@esf.edu)

Dilemma: Debate, the conference theme, has but one explicit reference to people, and that is through the title “Identity.” Identity might be used as an umbrella category for the people who have been marching through the streets of American cities and demanding justice. The Black Lives Matter movement and other organized efforts to call attention to disenfranchised people is certainly a dilemma worthy of debate. What role does landscape architecture or urban design have in this debate?

In 2014, the author conducted a randomized survey of 120 people (38% response rate) in one of the poorest neighborhoods in the City of Syracuse, New York. The survey consisted of a 30-minute in-home questionnaire addressing neighborhood perceptions, social capital, health status, mental health, nutrition, and physical activity. The result of the survey is a very rich description of people who live in a place that bears a striking resemblance to the Baltimore neighborhood of Freddie Gray. In this paper, survey results will be paired with spatial analysis of the neighborhood to reveal relationships between relevant features such as parks and natural features, gang territory, owner-occupied housing, and crime locations. Results are compared with other neighborhoods in the City of Syracuse and with the results of similar health surveys conducted in other cities.

The Syracuse neighborhood survey results are unique in their detailed portrayal of an inner city neighborhood, and they raise some interesting, and troubling, questions about how designers might respond in ways that improve the lives of the people who live in such segregated, disenfranchised places in the hearts of our cities. Discussion of results will include issues of walkability/physical activity infrastructure, landscape management and cues to care, and the effects of crime prevention through environmental design initiatives. By connecting research data to physical planning and design theories and approaches, this paper offers insights into what design offers and where design falls short regarding this dilemma. Further debate should illuminate many future research possibilities for designers.

# Design for a ‘wicked problem’

**Jamie Vanucchi** Cornell University

“Sharing Rivers” is an experimental joint course offered Fall 2015 at both Cornell University and State University of New York College of Environmental Science and Forestry (SUNY-ESF). This course is meant to foster transdisciplinary collaboration among a group of students from these two universities to explore a “wicked problem”. Systemic and multivalent, wicked problems present dilemmas that cannot be easily resolved, especially via traditional methods attempted by singular disciplines, but require alternative approaches from teams contributing diverse perspectives and skillsets.

Through the “Sharing Rivers” course, students and faculty will construct a design process framework for addressing a “wicked problem” that can be built upon and refined in subsequent years. This semester’s project involves an exploration of the removal of the Conowingo Dam on the Susquehanna River, about 10 miles north of the river’s mouth at the Chesapeake Bay. A recent opinion piece written by co-instructors Karin Limburg and John Waldman (2015) proposing the removal of the Conowingo Dam was followed by heated online discussion among its readers. Such debate is expected given the many conflicting interests and values involved with the use of our waterways, and raises many important questions of our time, including: how might we imagine a new infrastructure that allows for the sharing of the Susquehanna among multiple competing stakeholders and functions? How do we reestablish fish migration pathways that East Coast diadromous species require to restore fisheries that were once a wild and bountiful food source for Americans? How do we best manage our natural resources to balance ecological integrity with human needs like “green” energy production and recreation? How do we deal with the toxic legacy of industry and the effects of agriculture on waterways?

Students from landscape architecture, city and regional planning, aquatic and fisheries science, ecological engineering, hydrology and ecological economics are teamed to address these questions. Our process involves research and data collection, mapping and drawing to synthesize and correlate information from disparate sources and lectures and workshops with practitioners and experts in alternative energy, sediment stabilization, dam safety and regulation, dam removal and fish and wildlife. Finally, we will test a dam removal design scenario that recognizes the many conflicting pros and cons of dams, diverse value sets and the compromise necessary to address the issues.

# Alternative Visions for Utah's Public Lands: A Comparative Case Study Analysis of Public Lands Transfer Precedents

**Ole Sleipness** Utah State University  
[ole.sleipness@usu.edu](mailto:ole.sleipness@usu.edu)

**Benjamin George** Utah State University  
[benjamin.george@usu.edu](mailto:benjamin.george@usu.edu)

This study evaluates precedents of public land transfers of various scales in order to illustrate potential landscape impacts, should Utah prevail in its effort to gain control of federal lands within its borders.

Public lands in the American West are both highly valued and politically contentious. As described in Meinig's (1979) *The Beholding Eye: Ten Versions of the Same Scene*, many within the New West view public lands through competing lenses that are shaded by divergent experiences, interests, and values. These contested landscapes often provide the stage for struggles between utilitarian resource extraction vs. natural amenity-based development and recreation, state vs. federal management regimes, public access vs. privatization, and their resultant clashes of cultures and values in a transitioning region.

With its high percentage of federal lands, internationally renowned recreational identity, and rapidly urbanizing population, Utah is currently at the center of a regional movement to transfer control of federal lands to state and local control (Stambo, et al., 2014). If successful, this political movement could have profound and long-reaching impacts on the spatial arrangement of future development, energy and resource extraction, recreational access, and the resulting identity imprinted on the broader landscape of the West.

This study evaluates historic precedents of large-scale public land transfers in order to demonstrate potential scenarios for such a large-scale transfer within Utah and elsewhere in the West. These precedents include the Tennessee Valley Authority, Hawaii's successful acquisition of federal lands, and other Western states' use of their state trust lands within proximity of urbanizing centers (Arizona State Land Department, n.d.). Through a review of literature and analysis of archival records associated with comparably impactful public lands transfers, these case studies depicting a range of scales are evaluated and categorized using a grounded theory approach to illustrate potential long-term scenarios with an emphasis on impacts related to settlement patterns, recreational access, and regional identity.

As in the past, the West is poised to experience dramatic shifts in power structures, cultures, and their resulting landscape transformations. The examined precedent studies present residents, advocates, and planning and design professionals with a poignant and striking contrast in alternative scenarios for the region. While individuals and groups view the West's public lands from vastly different perspectives, the analyzed precedent studies offer similarly competing narratives of place, values, and identity.

# Alternating Intuition and Analysis: Assessing the Changing Relationship between Research and Design in Landscape Architecture

**Lee-Anne Milburn** Cal Poly Pomona  
[lsmilburn@cpp.edu](mailto:lsmilburn@cpp.edu)

**Robert Brown** University of Guelph  
[rbrown@uoguelph.ca](mailto:rbrown@uoguelph.ca)

Past research (Chenoweth and Chidister 1983; Milburn and Brown 2003) has documented a change in the culture of the discipline of landscape architecture relative to the perception of the role of research in the design process, and the relationship between research and design as separate, consecutive, integrated, or concurrent processes. To develop a picture of these changes over the past 30 years, a follow-up study was conducted with the same population as these two seminal studies, using many of the same questions.

A self-administered questionnaire based on the Dillman (1978, 2002) method was mailed and emailed to all assistant, associate and full professors listed as landscape architecture faculty on the Council of Educators in Landscape Architecture website. After three mailings and several email reminders, the combined return rate from the hard copy and survey monkey survey was 51%. Respondents ranged in age from 33 to 76, with an average age of 55.5 and were 33.3% female and 66.7% male. 42.1% had Ph.D. degrees. Results suggest that the average age of faculty is older, with more female and more PhDs than 16 years ago. The median number of conference presentations per year is almost twice the average from 1998, and the number of refereed articles has increased by 40%. Generally attitudes toward research are much more positive, with notable increase in support for the use of research during and after design (rather than just before design).

Results highlight that research is considered most important for design at the initial stages of the design process for both academics and practitioners. For academics, it is also considered an important tool for the evaluation of design performance (or potential performance). The importance of post-construction evaluation as a research topic increased notably since 1999. In general, research is not valued as an evaluation tool during design: rather it is used to predict design effectiveness.

## DILEMMA : DEBATE FILM TRACK



# In Motion: Reimagining Landscape Architecture Representation

**Windy Gay**

Just as motion is integral to landscape architecture, it is also integral to the images we create which articulate our landscape design ideas. An exploration into the use of time based media in the representation of landscape architecture has been solicited by some of the most influential theorist in the field. This film explores the potential embedded within moving images. It studies these ideas by re-rendering process drawings, as well as final drawings, from a previously designed alleyway project in Albuquerque, New Mexico. The result is a five-minute animation constructed primarily in Adobe AfterEffects. Within the animation, the design is revealed through several moving diagrams, poetic animations, and finally a fully articulated representation of the finished landscape design.

This project emerged as a response to the discipline's decade long dialog about the importance of time in landscape architecture. Over the last decade, landscape architecture theory has been grappling with the notion of time and how it informs our designed and undesigned landscapes. Many theorists assert that representational techniques will evolve through innovative and creative use of new technologies. James Corner asserts that any recovery of landscape in contemporary culture is ultimately dependent on the development of new images and techniques of conceptualization<sup>1</sup>. In addition, Marc Treib, although more cautious in his claim, finds that we cannot ignore our current digital age and agrees that time based media offers great possibilities in representing landscape<sup>2</sup>. There has been a call to explore the vast new technologies that exist, such as 3-D modeling, video, multi-media tools, and animation tools, and to incorporate them into the ideas and practice of landscape architecture. As of yet there has been little exploration of these time based mediums as tools to represent designed landscapes, neither for discovering design ideas, nor as a method of creatively expressing design intentions. This new approach does not devalue or abandon traditional methods, but expands on them, offering a rich new hybrid form of design representation that is both useful in the classroom as well as in practice.

The animation is found at <https://youtu.be/jxZu38OnIjk>

# Animating the Benefits of Landscape Architecture: Four Strategies for Engaging Diverse Audiences through Video Shorts

**Blake Belanger** Kansas State University  
[belanger@ksu.edu](mailto:belanger@ksu.edu)

**Alpa Nawre** Kansas State University  
[anawre@ksu.edu](mailto:anawre@ksu.edu)

In 2015, the total number of world wide web users is at a staggering 3.17 billion and short films have become one of the most powerful digital communication tools of this age. Short films provide a unique and largely unexplored opportunity for landscape architects to advocate for the discipline, raise awareness of the general public, and educate young people. This study describes strategies used to guide four different types of short films that mid-level MLA students at Kansas State University prepared to communicate how landscape architecture impacts the daily lives of people.

Each of these short films, developed for the CLARB 2015 Wayne Grace Competition, develops a different method for crafting an argument in support of landscape architecture. The first film narrates a picture book adventure of Paisley, a little girl who discovers how landscape architects create aesthetically pleasing and visually inspiring neighborhoods and communities. The second is a dramatic story that illustrates how designed landscapes promote health and well-being. The third video is a series of time-lapse sketches that describes how landscape architecture strategies build community, using Klyde Warren Park as a case study supported with social media posts and statistics. The final video compiles infographics and case studies communicating how landscape architecture delivers economic benefits to communities and development projects.

In developing these films, several lessons were learned. Firstly, these films can be a very powerful means of addressing and communicating with different age groups. For example, the film about Paisley targets an audience of primary and middle-school children, not only because its main character is a young girl but also because of its narrative style which resembles an animated picture book. Secondly, video can engage people by appealing to their emotions, while also conveying important information about the discipline, most clearly expressed in the drama film. The time-lapse video demonstrates a method for artistically capturing an audience and sharing community members' thoughts through social media posts. The final film provides a lens for appealing to financially-minded audiences by supporting claims with economic data. The study concludes that video provides multiple methods for communicating benefits of landscape architecture to diverse audiences, and presents untapped opportunities for professional organizations, academics, and professionals. The students gained a deeper understanding of specifically how landscape architecture benefits the public welfare and learned approaches for articulating arguments for targeted audiences using video shorts.

The videos are available at <https://lapublicwelfare.wordpress.com/> (numbers 2, 3, 4, and 6)



# Integrating Time-based Media into the Design Process

**Natalie Yates** Washington University

This paper examines the incorporation of time-based media [recorded sequences, video, animation, simulation, remote sensing, etc.] as a tool for design process. It reflects on the practice of capturing, producing and analyzing moving imagery as a method of inquiry for design through presentation of student work developed in a seminar class called Videography for Designers. Through the seminar, students explore theory and techniques from a range of disciplines – art, design, sociology, anthropology, medicine, etc. and then re-interpret these methods, focusing on different stages of the design workflow.

The social sciences have been using time-based media (film) as a means of analysis for much of the 20<sup>th</sup> century. In the early years, digital media was limited to the average person; however, the 1980s and 1990s changed this paradigm with large leaps in technological progress. Video, and the means to disseminate it, allowed more wide use. Internet accessibility, streaming media, relatively small and cheap capture devices, cell phones, big data, and user-friendly software have increasingly made time-based media accessible to and easily used by everyone. Video, digital sequences, slideshows, and animation, along with the ability to edit, reformat, and distribute, opened new possibilities to produce and present information.

Film and video possess analytical and communicative properties that can reveal multiple layers of information through a single vantage point. Unlike still imagery, time-based media is capable of integrating the static and the fluctuating, the relativity of time, motion, and transformation compressed into a singular gaze. It can reveal both visible and invisible flows and forces. As we increasingly design to address issues of climate change, resource management and maintenance, it is imperative that we express the value of landscape processes. Time-based media allows us to engage time and change in order to express complex spatial relationships, evolving and multiple perspectives, analysis of performance, interpretation of seen and unseen forces, networks of flows, and experience.

Short videos, edited clips, animations and animated GIFs shared via YouTube, Vimeo and social networking sites make it easy to communicate experiences and processes that go beyond the static image. In the seminar, students develop short projects to establish methods to document, reveal hidden characteristics, measure change, express conceptual ideas, and visualize transformation throughout the design process.

The presentation will be supplemented by a curated selection of original student video/animation work. These works will be paired with supportive precedent examples to provide context and explanation of methods and objectives.

Examples of Video Shorts:

Motion Sketches Gallery

<http://www.transitory.space/#/motionsketches/>

Project Shorts Gallery

<http://www.transitory.space/#/projects/>

Walking and Observing: Two Ways of Experiencing Space in Forest Park

<https://vimeo.com/124007792>

Rainwater Catchment Facility: A Virtual Reality Walkthrough created for Oculus Rift

<https://www.youtube.com/watch?v=YVmf4YbN9KU>

# Animating Poetics of the Konza Prairie, Part Two: Summer and Fall

**Jon Hunt** Kansas State University

[jdhunt@ksu.edu](mailto:jdhunt@ksu.edu)

The ‘Animating Poetics of the Konza Priairie, Part Two: Summer and Fall’ is a short animation based on drawings and narratives completed during weekly walking excursions to the Konza Prairie (an active tallgrass prairie and long-term ecological research facility bordering Manhattan, Kansas). While hiking the paths, I documented the landscape through drawing and writing my observations and understandings of the prairie. Whereas Part One (which was exhibited last year in the CELA 2015 film track) focused on winter/spring and the spatial qualities and wildlife, Part Two focuses on summer/fall and detailed characteristics (vegetation, textures, and colors) of the Konza Prairie.

Traditional hand-drawn, mixed media, photo-transfers, and printmaking images were animated with traditional layering motion processes and rotoscoping techniques. Adobe After Effects, Adobe Premiere and additional computer applications were applied to enhance the spatial qualities of the landscape. The multimedia are combined to reflect the relationships between vegetation, the earth and the seasonal changes.

# Experience | Contemplation | Intervention: A Site Through Films

**Kris Fox** University of British Columbia  
[kfox@sala.ubc.ca](mailto:kfox@sala.ubc.ca)

The site was the approach to Pitt Lake Park through the Addington Marsh Wildlife Management Area, a 2,972 hectare site of picturesque British Columbia ‘super natural’ beauty, just minutes away from Greater Vancouver. Students were asked to find Mircea Eliade’s “sacred mountain, where heaven and earth meet... situated at the center of the world.” Dropped off a couple of kilometers away from the lake shore, they would find their way to and through the site. By hiking, cycling, canoeing and taking time to sit in this place, students spoke of “serendipitous reveals” and the feeling of being dwarfed in an amphitheater of 1,600 meter peaks. The question wasn’t whether or not the vitality of the place had touched them, but how to record this. Similar to many design studios, they transferred the energy generated by their site explorations into drawings and models, but their short 2-5 minute films became the place where they captured the very visceral and physical experiences they had in this awe-inspiring place.

In each studio that I have introduced film, it was the first time that my students had been tasked with using it as a primary medium for design output, though arguably it may be the medium they are most familiar with. The assignment came to them in a studio entitled, LAND<>ART: The Sacred and the Profane, wherein they were challenged with establishing a position within the evolving dialog between landscape architecture, land art and spirituality. For the project, their exploration started with the viewing of two films to establish the dialog of place: Robert Smithson’s “Spiral Jetty” and Nancy Holt’s “Sun Tunnels”. Through these short films, these artists illustrated several things that are difficult to show through drawings and models, such as sequences of spaces and events, measurements of time and mood. The students were asked to approach these topics through their short films. The short films the students created captured the sequences of movement to the “sacred mountain” and fostered a deeper understanding of the temporal attributes of the site in addition to the spatial experiences. The exposure to film allowed the students to discover, analyze and contemplate this place in a way that opened up new avenues of expression and processes.

Video Library: <https://vimeo.com/album/3700760>

# A Pretty Heroic Endeavor – Communicating the Impact of Landscape Architecture on Public Welfare through Video Animation

**Lovisa Kjerrgren** SWA Group  
[lkjerrgren@swagroup.com](mailto:lkjerrgren@swagroup.com)

“You’re a landscape architect? How lovely! Perhaps you can look at my garden?” As harmless as this notorious response to a landscape architect’s introduction may seem, it points to a problematic discrepancy. Although the profession encompasses increasingly diverse, complex, and interdisciplinary contexts of practice, most people have a limited understanding of what landscape architecture is and what it means to their lives.

How can we raise awareness about the impact of landscape architecture among clients, stakeholders, and users? It is a challenge that brings forth a dilemma of communication where negotiations between the actual complexity of the field on one hand, and the accessibility and appeal of information on the other, are inevitable. Responses can take many forms, such as public outreach campaigns (like ASLA’s “Landscape Architecture: Your environment. Designed.” (1)) or films and documentaries highlighting the impact of design (like Gary Hustwit’s “Urbanized” (2)). Exemplifying one possible approach, this presentation will show a short video animation that communicates to the general public about the impacts of landscape architecture on public welfare.

The video was the winning entry of the 2015 Wayne Grace Memorial Student Competition, organized by the Council of Landscape Architectural Registration Boards (CLARB). It highlights how the things people often take for granted in their surroundings are in fact deliberately designed, and how the design enhances their lives. Using animation, the video illustrates how the work of landscape architects impacts on our environments, communities, and everyday lives.

The background of the competition challenge and the research base of the video was CLARB’s “Landscape Architecture and Public Welfare” study (3). It establishes a definition of public welfare in relation to landscape architecture, and presents seven ways in which landscape architecture promotes public welfare. This presentation will elaborate on the rationale, considerations, and insights from the process of reducing the research report down to a clear and straightforward gist, developing a second person narrative, and depicting it in a simple and playful manner.

Link to video: <https://www.youtube.com/watch?v=nsJXnQmxU8g>

## CONFERENCE PAPERS

\*the included papers were not reviewed



# **THE MIASMIST: GEORGE E. WARING, JR. AND THE EVOLUTION OF MODERN PUBLIC HEALTH**

**SEAVITT NORDENSON, CATHERINE**

The City College of New York, New York, NY 10031

[cseavitt@seavitt.com](mailto:cseavitt@seavitt.com)

## **1 ABSTRACT**

*George E. Waring, Jr. developed an influential manual in 1867 entitled *Draining for Profit, Draining for Health*, reflecting two particular obsessions of the gilded age—wealth and miasma. The long-held miasma, or anti-contagionist, theory held that the origin of disease was in the air, emerging as a poisonous vapor from rotting organic matter in damp soil. By the 1880s, the new contagionist theory of the germ was gaining European support, yet Waring remained a lifelong miasmist, supporting the anti-contagionist movement in the United States. Believing the cause of disease to be the result of excess moisture in the ground—the “ground water theory” developed by German scientist Max von Pettenkofer—Waring prepared a comprehensive drainage plan for Central Park in 1856. His title, *Superintendent of Drainage*, seems unusual, but the very idea of Central Park was to provide much more than a place of recreation and open space within the city—its acreage was a carefully constructed argument to combat disease in an increasingly crowded city. The park was conceptualized not as a captured territory of unspoiled “nature,” but as a massive air, water, and ground cleansing machine that would restore health to the urban populace. Waring drew on his knowledge of farm drainage and applied it to this urban park on a massive scale, mechanically transforming locations of damp ground from their existing hydrology into a gravity-fed hydraulic system that would quickly shed surface and ground waters.*

*The miasmists, their theories disproved by the success of germ theory in the early twentieth century, failed brilliantly in the urban realm, leaving an extraordinary contemporary legacy. Their focus on the physical environment developed into contemporary urban public health strategies supporting a healthier populace. Waring’s mechanized park serves as both an atmospheric scrubber and carbon sink. His reforms at the Department of Street Cleaning in New York City, separating waste by category, led to modern practices of recycling and waste reduction. His separated sewer system at Memphis is the radical solution to antiquated combined systems that discharge stormwater and raw sewage into adjacent waterways, and his sewage work in Havana, Cuba helped reduce yellow fever. Reinterpreted today, the miasmists’ emphasis on clean water, air, and soil reflects much more than a singular concern with disease transmission. Their environmental focus, based on scientific error, nonetheless supports the contemporary vision of reducing the environmental impact of urban actions on the atmosphere, waterways, and planet.*

## **1.1 Keywords**

George E. Waring, Jr., Central Park, public health, drainage, miasma, contagionism

## 2      **GEORGE E. WARING, JR.**

Colonel George E. Waring, Jr. was born in Pound Ridge, New York in 1833 (Fig. 1). His father ran a successful foundry in Samford, Connecticut, manufacturing stoves and agricultural tools. Young Waring was educated as an agricultural scientist, avidly reading the current scholarship from Europe about new farming practices. In 1855, he moved to Chappaqua, New York, to manage the farm of the editor of the *New-York Tribune*, Horace Greeley, who was also a New York congressman and a one-time presidential candidate. Greeley dabbled in experimental agriculture on his Chappaqua farm, writing about these techniques in his popular weekly column in the *Tribune*, which attracted a vast number of readers from rural America. Greeley also constructed an unusual concrete barn on the property, naming it the Rehoboth. This was one of the first concrete structures in the United States, and it drew visitors to Chappaqua from far away—indeed, Greeley wrote that he considered this barn his life’s finest accomplishment. [1] Waring’s work as farm manager gave him the opportunity to develop the novel techniques and tools of field drainage that he later developed into the influential manual of 1867 entitled *Draining for Profit, Draining for Health*, a lovely title reflecting two particular obsessions of this gilded age—wealth and miasma. [2] The long-held miasma theory held that the origin of disease was in the air, emerging as a poisonous vapor from rotting organic matter or the soil. By the 1880s, strong support of the new contagionist theory of the germ was gaining support in Europe, yet Waring remained a lifelong miasmist and supporter of the anti-contagionist movement in the United States. And along the trajectory of his career from farm manager to drainage engineer to public health advocate, Waring’s mechanistic battle against miasma morphed from the scale of the rural farm to the large urban park to the entire city.

## 3      **CENTRAL PARK, NEW YORK**

Egbert L. Viele (1825-1902), a West Point graduate and civil engineer, transformed Waring’s career. Viele is well known for his highly detailed 1865 *Sanitary and Topographical Map of the City and Island of New York*, the ‘water map’ of Manhattan overlaid with the Commissioners’ Grid of 1809, identifying the historic streams, marshes, meadows, and ‘made land’ that transformed the shoreline of Manhattan, along with the city’s main sewer lines. The map was prepared for the report of the Council of Hygiene and Public Health of the Citizens Association. But Viele had produced earlier surveys of Manhattan as well. In 1853, just after the City of New York legislated the Central Park Act, identifying as public land the parcel that was to become Central Park, Viele began a survey of this terrain, described in the Act as the land ‘bounded southerly by Fifty-ninth-street, northerly by One Hundred and Sixth-street, easterly by Fifth Avenue, and westerly by Eighth-avenue.’ [3] (Fig. 2) In 1856, Viele was appointed Chief Engineer of the future park by the First Central Park Board of Commissioners. Viele, himself an ardent miasmist, embraced the well-known ‘ground water theory’ of disease developed by the German scientist Max Joseph von Pettenkofer (1818-1901) in the 1850s. Believing the cause of disease and fevers to be the result of noxious ‘odors’ emitted from excess moisture in the ground, Viele prepared a preliminary drainage plan for the park from 1856 through 1857, an eleven-foot-wide drawing entitled *Plan of Drainage for the Grounds of the Central Park*. In August 1857, 24-year-old George E. Waring Jr. was hired by Viele as his Superintendent of Drainage—Waring assisted with the development of this drainage map and insisted, to the apparent annoyance of Viele, that his name be added to the title. [4] Shortly afterward, in September 1857, Frederick Law Olmsted was appointed by the Board of Commissioners as Superintendent of Central Park, reporting to Egbert Viele, Chief Engineer.

Waring’s new title, Superintendent of Drainage, may seem an unusual one for a project to construct a public park. But the very idea of Central Park was developed to provide much more than a place of recreation and open space within the city—those initial 778 acres were part of a carefully constructed argument to combat disease in an increasingly crowded city. Indeed,

the park was seen not as a captured piece of unspoiled 'nature,' as it is often characterized, but rather conceptualized as a massive air, water, and ground cleansing machine that would restore health to its urban citizenry. Medical science, until the transformative European germ-theory discoveries of Robert Koch and Louis Pasteur in the 1870s and 1880s, held that epidemic diseases such as cholera, typhoid, and yellow fever were caused by a noxious miasma, a word deriving from the ancient Greek *Μίᾱσμα*, or 'bad air,' emerging from rotting organic matter in the ground. The miasma theory was further developed in the nineteenth century by the British sanitarian Edwin Chadwick, who posited that diseases were caused by a place, by an environment, by an odor—not by another infected person or agent. And that place, identified by its foul smell, was one with contaminated water, poor hygienic conditions, and decomposing organic matter. Pettenkofer and others believed it developed in deep wet ground as a poison, emerging as a diseased ground exhalation. Thus, in late nineteenth-century New York, the medical miasmists gave rise to this position of Waring as Superintendent of Drainage, transforming him from an agricultural engineer into an urban sanitary engineer. Waring drew on his agricultural knowledge of farm drainage and tiling and applied it to an urban park on a massive scale. He would mechanically transform the nature of this ground from its existing hydrology into a gravity-fed hydraulic system, quickly shedding and transporting surface and ground waters from the territory of the park.

In September 1857, the First Board of Commissioners of the Central Park requested that its new Central Park Superintendent, Frederick Law Olmsted, provide a comprehensive plan for draining the land of the park. This request came just one month prior to the launch of the competition for the design of the new Central Park, advertised in October 1857. Olmsted, ever strategic, knew the terrain well thanks to Viele's comprehensive topographic survey. He responded to this request, the first since his appointment as Superintendent, by stating the following:

'Owing to the exceedingly diverse character of the ground, the great amount of rock, both above and below the surface, with which it is encumbered, and its numerous springs, hidden and superficial, a detailed plan of drainage for the Central Park could only be formed after such a careful study as a proper attention to the ordinary duties of my office forbids me at present to give to the subject. The depth and direction of the drains must be, in many cases, also, adjusted to the elevation of the brooks, cascades, and standing water, which will be established solely on artistic grounds, as well as to the roads which may be lain out. Until therefore, a complete plan of the Park shall have been definitively determined on, I think it would be unwise to carry a consideration of the drainage-plan beyond the adoption of certain fundamental rules, to which even the landscape design should be subordinate.'

(Olmsted 1857, in Beveridge and Schuyler, eds. 1983: 94)

Olmsted goes on to insist upon these fundamental rules of drainage: the drainage of the park should be 'thorough,' meaning a completely comprehensive system of underground drainage tiles, a 'mechanical improvement' removing all excess water; the drains themselves should be ceramic tubes of one-inch diameter and greater, in sections laid end to end; and the drains should be set at a depth of three feet in the open glades and at a depth four feet in the wooded areas, and in both cases spaced fifteen feet apart.

A month after writing this letter to the Commissioners, Frederick Law Olmsted and Calvert Vaux entered the competition to improve and expand New York's Central Park. In April 1858, their Greensward Plan was selected as the winning entry. Viele would become Olmsted's frustrated rival, while Waring would continue to work closely with Olmsted, developing a close relationship with him and even renting his family farm on Staten Island. Olmsted and Vaux's Greensward Plan won on the grounds of artistic achievement. Viele also submitted a proposal to the competition, but lost. Indeed, Viele's submission to the competition was dismissed by Clarence Cook as being 'just such a matter-of-fact, tasteless affair as is always produced by



engineers, when they attempt anything in the way of ornamental design.’ (Cook 1869: 25) Shortly after selecting the submission of Olmsted and Vaux, the Commissioners dismissed Viele and promoted young Waring, who had assisted Viele on his earlier drainage plan for Central Park, as the new Drainage Engineer for the execution of the Greensward Plan.

Immediately upon the award of the commission for the Greensward Plan, Olmsted began implementing ‘thorough’ drainage based on the new plan drawn by Waring. The Second Annual Report of the Board of Commissioners of the Central Park, published in January 1859, includes a beautiful drawing entitled *Map of the Drainage System on Lower Part of the Central Park as far as completed up to December 31<sup>st</sup>, 1859*. (Fig. 3) In this drawing, which includes the southern section of the park from 59<sup>th</sup> Street to the 66<sup>th</sup> Street transversal road, major rock outcrops are identified with topographic shading, lawns are lightly shaded, and paths are left unshaded. The red lines represent the tile drains, red circles are the silt basins, and the heavy black lines indicate the sewers. In Olmsted’s words, the park is ‘mechanically improved.’ Olmsted later described Waring as the man who ‘planned and superintended the work of agricultural drainage, superficial and thorough, upon the Central Park from the outset. I believe it to be the best work of the kind in the world. The difficulties he met were great and various and the experience acquired in overcoming them must be very valuable for any similar undertaking.’ (Olmsted 1860, in Beveridge and Schuyler, eds. 1983: 105)

## **2 MEMPHIS**

In 1861, after completing his work on the Central Park drainage, Waring enlisted in Union Army at the onset of the Civil War, accepting a commission as a Major in the 4<sup>th</sup> Missouri Calvary. He was promoted to the rank of Colonel in 1862. After the end of the war in 1865, Waring returned to Rhode Island and his career of farm management, but continued to expand his work on sanitary engineering. Waring began by advocating sewerage within the individual house, then expanded this theory to advocate for the necessity of cleansing entire communities in order to prevent disease. [5] Pure air, pure water, pure soil: this was the ‘sanitary idea’ as presented by Edwin Chadwick in 1828, borrowed from the ancient Hippocratean ideal, and was to be considered at the scale of the city. Waring landed the opportunity to test sanitation at an urban scale in 1878, after the devastating yellow fever epidemic in Memphis, Tennessee that infected around 17,000 people and killed over 5000. Appointed by President Rutherford B. Hayes as a Commissioner working with the National Board of Health, Waring was charged with creating a plan for the sanitary improvement of Memphis. He proposed a complete sewerage system—his work for the ‘thorough’ drainage of Central Park was now expanded to a city scale. Interestingly, Waring championed and installed a ‘separate’ sewage system—the alternative to the ‘combined’ sewage system and its overflows that are still the environmental plague of large urban cities such as New York and Chicago. Waring claimed that his separate sewer system, the ‘Memphis’ system, had banished yellow fever from Memphis. [6] Though better drainage did keep waste water away from drinking water wells, yellow fever was not in fact spread by inadequate sanitation, but by the *Aedes* or *Haemagogus* species mosquito, which breeds in stagnant water. But this connection had not yet been established, and for now, a battle was won in Memphis in the ongoing debate between the contagionists and the miasmists.

## **3 NEW YORK CITY**

In 1894, Waring was appointed Commissioner of the Department of Street Cleaning of the City of New York, the predecessor of today’s Department of Sanitation. Waring radically and aggressively reformed the department, outfitting the men in white canvas uniforms, updating the

street-cleaning and garbage collecting equipment, and establishing military-like discipline. (Fig. 4) Under his leadership, and in the name of health and cleanliness, the streets of New York were cleared of waste in daylight hours by this new corps of streetcleaners, the 'White Wings.' Waring established new practices, including the separation of trash at each household (organic garbage, ashes, and rubbish), a rubbish-sorting plant, a reduction plant at Barren Island, and land reclamation at Rikers Island. Waring wrote of his department:

'An inefficient and ill-equipped working-force, long held under the heel of the spoilsman, has been emancipated, organized, and brought to its best. It now constitutes a brigade three thousand strong, made up of well-trained and disciplined men, the representative soldiers of cleanliness and health, soldiers of the public, self-respecting and life-saving. These men are fighting daily battles with dirt, and are defending the health of the whole people. The trophies of their victories are all about us—in clean pavements, clean feet, uncontaminated air, a look of health on the faces of the people, and streets full of healthy children at play.'

(Waring 1896: 190)

His efforts were successful. The streets of New York, once shin-deep with waste, were swept clean on a regular schedule. In 1896, Waring orchestrated a grand parade of his sanitation men in their white uniforms and helmets down Fifth Avenue—he led the parade, astride a white stallion. Though his position as Commissioner ended in 1898, his innovative reforms led to permanent improvements in the street cleaning and garbage collection services in New York, and served as an example for many other cities. It was the miasma theory at its finest—anti-filth, clean, and pure white.

#### **4 HAVANA**

In 1898, at the end of the Spanish American War, United States Army commanders were concerned with the risk of yellow fever to the troops that would be occupying post-war Havana. Indeed, it was this fever which had caused most of the American casualties during the war. Waring was appointed by President William McKinley as the chairman of the Commission charged with making suggestions for the proper sanitation of Havana and the army camp sites in Cuba, and he arrived in Havana in October 1898. He surveyed Havana for three weeks, noting the extensive marshes, its lack of sewers, the abundant filth and garbage in the streets, and the lack of any street cleaning or garbage disposal plan. Waring drafted a proposed set of recommendations during his return trip to the United States, including the construction of a complete sewerage system, extensive street paving, thorough marsh drainage, and the organization of a Department of Public Cleansing. [7]

The day after his return to New York, Waring contracted a fever. He died of yellow fever four days later, at the age of 65, on October 23, 1898. Public health officials in the city, now adhering to the contagion theory of disease transmission, required that his body be placed in a hermetically-sealed metallic casket and transported by a quarantine boat to Swinburne Island in New York Harbor, where his remains were cremated. [8]

#### **5 EPILOGUE**

Did Waring's death ironically demonstrate the futility of the miasma theory? Though it appears the contagionists may have won the final battle, Waring's death by yellow fever was not in fact caused by a contagious disease transmitted person-to-person. There was no need for the extraordinarily careful handling of his remains. Two years after his death, in August 1900, the United States Army physician Walter Reed proved that yellow fever was spread by a bite from an infected *Aedes aegypti* mosquito. (Fig. 5) Waring and other miasmists' focus on the

environmental factors of disease control were somewhat on the right track—although they did not realize that the importance of draining was to eliminate the breeding grounds of mosquitos, not to eliminate the noxious exhalations of the earth.

Though the theory of miasma was disproven by the success of germ theory in the early twentieth century, the miasmists, particularly George E. Waring, Jr., failed brilliantly in the urban realm, leaving an extraordinary legacy. Their focus on the environment developed into contemporary urban public health strategies supporting a cleaner, healthier planet as well as healthier inhabitants. Waring developed a fascinating mechanical park, an atmospheric scrubber and carbon sink. His reforms at the Department of Street Cleaning in New York City led to modern practices of recycling and waste reduction. His separated sewer system at Memphis is the envy of antiquated combined systems that discharge raw sewage into adjacent waterways with each moderate to heavy rainfall. Today, the miasmists' emphasis on clean water, clean air, and clean soil reflects not so much a singular concern with disease transmission, but a contemporary vision to reduce the environmental impact of urban actions on the atmosphere, waterways, and planet.

## 6 ENDNOTES

- 1 For more on Greeley's experimental agricultural practices, with an extensive discussion of the concrete barn and strategies of drainage, see Horace Greeley (1871), *What I Know of Farming: A Series of Brief and Plain Expositions of Practical Agriculture as an Art Based upon Science* (New York: The Tribune Association).
- 2 Waring argues for thorough land drainage wherever possible, stating, 'Land which requires drainage hangs out a sign of its condition, more or less clear, according to its circumstances, but always unmistakable to the practiced eye. Sometimes it is the broad banner of standing water, or dark, wet streaks in plowed land, when all should be dry and of even color; sometimes only a fluttering rag of distress in curling corn, or wide-cracking clay, or feeble, spindling, shivering grain, which has survived a precarious winter, on the ice-stilts that have stretched its crown above a wet soil; sometimes the quarantine flag of rank growth and dank miasmatic fogs.' See more in George E. Waring, Jr. (1867), *Draining for Profit, and Draining for Health* (New York: Lovejoy and Son).
- 3 The Central Park Act of 1853 and the delineation of this parcel of land is cited by Morrison H. Heckscher (2008), *Creating Central Park* (New York: The Metropolitan Museum of Art and New Haven: Yale University Press), 15. The precision of these boundaries and dimensions were predicated on siting the existing rectangular Receiving Reservoir, another hydraulic mechanism, at the exact center of the park.
- 4 See Benjamin Miller (2000), *Fat of the Land: Garbage in New York* (New York: Four Walls Eight Windows) for an account of the tense relationship between Viele and the younger Waring.
- 5 Waring was an early American proponent of the British-designed 'earth closet,' an alternative to the increasingly popular 'water closet,' which he claimed, in true miasmist style, could pose dangers to human health because of the noxious sewer gas which the defective units produced. For more on the earth closet, see George E. Waring, Jr. (1868), *Earth Closets: How to Make them and How to Use Them* (New York: Tribune Association). Later Waring wrote the influential 1884 *The Sanitary Drainage of Houses and Towns* (Boston: Houghton, Mifflin and Company), a book much admired by Olmsted.

- 6 For a full account of the seweraging of Memphis, see James H. Cassedy (1962), 'The Flamboyant Colonel Waring: An Anti-contagionist Holds the American Stage in the Age of Pasteur and Koch,' *Bulletin of the History of Medicine*, Volume 36, March-April 1962, pp. 168-170.
- 7 For a summary of Waring's incomplete report on Havana, drafted on his return trip to New York, see Albert Shaw (1899), *Life of Colonel George E. Waring, Jr.: The Greatest Apostle of Cleanliness* (New York: Patriotic League).
- 8 *Indiana State Journal*, Indianapolis, Indiana, Wednesday, November 2, 1898, 74/44: 2.

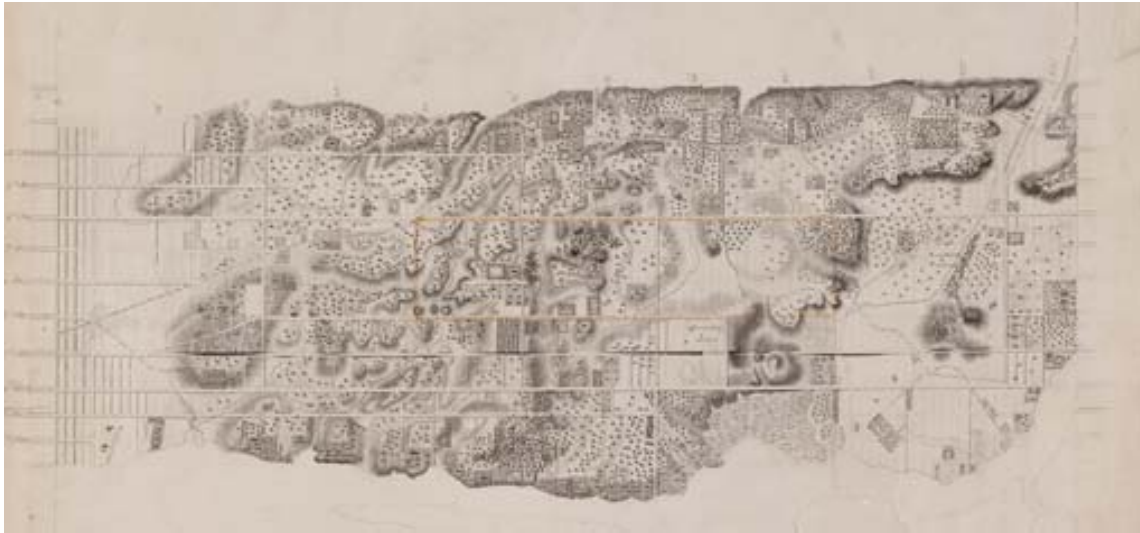
## 7 REFERENCES

- Cassedy, James H. (1962), 'The Flamboyant Colonel Waring: An Anti-contagionist Holds the American Stage in the Age of Pasteur and Koch,' *Bulletin of the History of Medicine* 36: 168-170.
- Cook, Clarence (1869), *A Description of the New York Central Park* (New York: F. J. Huntington and Co.).
- Greeley, Horace (1871), *What I Know of Farming: A Series of Brief and Plain Expositions of Practical Agriculture as an Art Based upon Science* (New York: The Tribune Association).
- Heckscher, Morrison H. (2008), *Creating Central Park* (New York: The Metropolitan Museum of Art and New Haven: Yale University Press).
- Miller, Benjamin (2000), *Fat of the Land: Garbage in New York* (New York: Four Walls Eight Windows).
- Olmsted, Frederick Law (1857), 'Letter to the Board of the Commissioners of the Central Park, New York, October 6, 1857,' in Charles Beveridge and David Schuyler (eds. 1983), *The Papers of Frederick Law Olmsted, Volume III: Creating Central Park, 1857-1861* (Baltimore and London: The Johns Hopkins University Press): 94-101.
- Olmsted, Frederick Law (1860), 'Letter to Thomas W. Fields, New York, May 2, 1860,' in Charles Beveridge and David Schuyler (eds. 1983), *The Papers of Frederick Law Olmsted, Volume III: Creating Central Park, 1857-1861* (Baltimore and London: The Johns Hopkins University Press): 105.
- Shaw, Albert (1899), *Life of Colonel George E. Waring, Jr.: The Greatest Apostle of Cleanliness* (New York: Patriotic League).
- Waring, Jr., George E. (1867), *Draining for Profit, and Draining for Health* (New York: Lovejoy and Son).
- Waring, Jr., George E. (1898), *Street-Cleaning and the Disposal of a City's Wastes: Methods and Results and the Effect upon Public Health, Public Morals, and Municipal Prosperity* (New York: Doubleday & McClure).

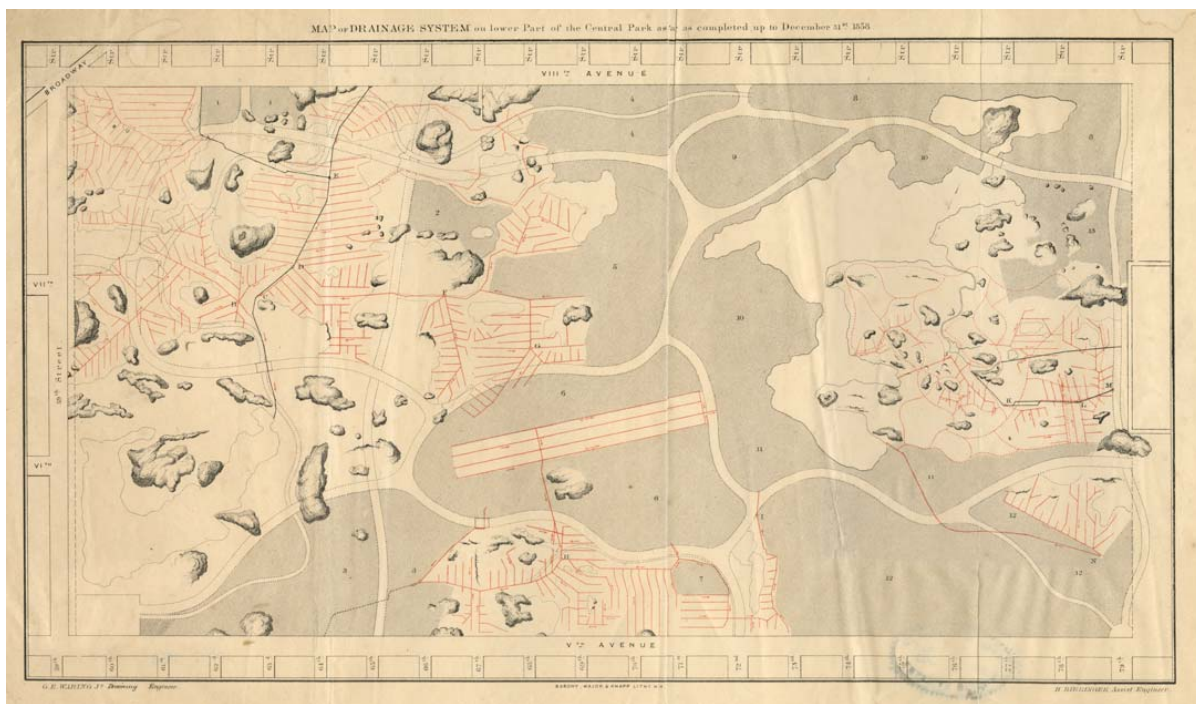
8      **FIGURES**



**Figure 1.** Colonel George E. Waring, Jr., full-length portrait, seated facing slightly left, 1897.  
Source: Library of Congress



**Figure 2.** David H. Burr, cartographer. *Topographical Map of the City and County of New-York*, c. 1836. The location of the parcel of land designated as Central Park was outlined in a sepia wash c. 1858. Source: Metropolitan Museum of Art, Harris Brisbane Dick Fund, 1924. Accession Number: 24.66.1492. [www.metmuseum.org](http://www.metmuseum.org)

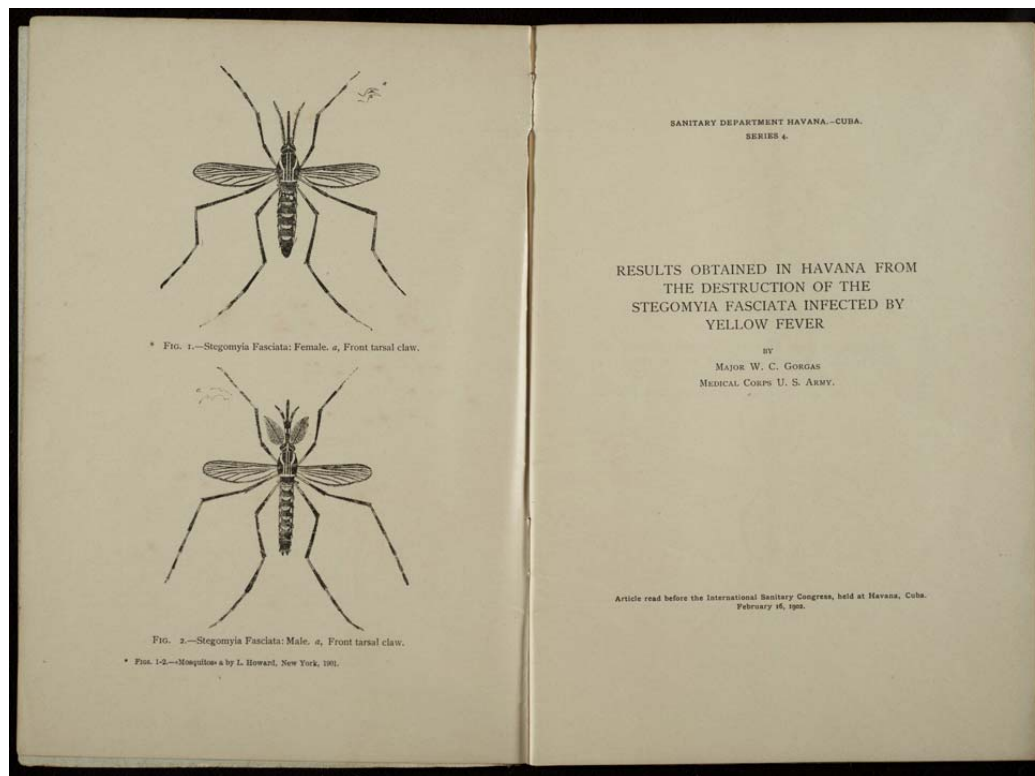


**Figure 3.** George E. Waring Jr., drainage engineer, and H. Bieringer, assistant engineer. *Map of Drainage System on Lower Part of the Central Park as far as completed up to December 31st, 1858*. Lithograph from the *Second Annual Report of the Board of Commissioners of the Central Park*, January 1859. Source: Collection of the New-York Historical Society. Call no. NS12 M9.2.41, Neg #80370d. Photography © 2015, New-York Historical Society.





**Figure 4.**  
A White Wing street sweeper with his handcart, 1896. These wheeled carts were designed by Waring's wife, Emily Waring. Source: New York Public Library



### Figure 5.

Frontispiece of the 1902 report entitled *Results Obtained in Havana from the Destruction of the Stegomyia Fasciata Infected by Yellow Fever*.

Source: US Army Medical Corps

### AUTHOR BIO

Catherine Seavitt Nordenson is an Associate Professor of Landscape Architecture at City College of New York and principal of Catherine Seavitt Studio. A registered architect and landscape architect, she is a graduate of Cooper Union and Princeton University, a Fulbright Fellow, and a Fellow of the American Academy in Rome. Her research includes design adaptation to sea level rise in urban coastal environments, as well novel landscape restoration practices given climate change. She is also interested in the intersection of political power, environmental activism, and public health, particularly seen through both the design of public space and the written word.





COUNCIL OF EDUCATORS  
IN LANDSCAPE ARCHITECTURE

**A CELA Conference Presentation**

**Abstract: 24**

## **A DIGITAL STORYTELLING: EFFECTIVENESS ON STUDY ABROAD EXPERIENTIAL LEARNING**

**LI, MING-HAN**

Texas A&M University, College Station, Texas 77843, minghan@tamu.edu

**QU, TONGBIN**

Texas A&M University, College Station, Texas 77843, t-qu@tamu.edu

**PETERSENN, TURE**

Akademie für Internationale Bildung, Bonn, Germany, petersenn@aib-studyabroad.org

### **1 ABSTRACT**

*Digital storytelling is a short digital media production that allows ones to share their life story. It has gained popularity in higher education since the late 1990s in the US due to a great extent that media production techniques, hardware and software are becoming much more accessible and affordable (Center for Digital Storytelling, 2015). The purpose of the study is to assess the effectiveness of digital storytelling as a reflection technique in the study abroad setting. In this paper, we introduce the process, result and evaluation of the application of digital storytelling on a course taught abroad. In summer 2015, 13 Texas A&M University (TAMU) undergraduate students went to Germany to learn about sustainable communities. The Academy for International Education (AIB) based in Bonn handled logistics, arranged field trips and invited guest speakers while TAMU faculty gave some key lectures. In one of the assignments, students were required to submit their own 3-minute videos in which they must reflect on their five-week learning and tell stories using their voice. Students learned about digital storytelling while they were abroad. Students presented their rough cuts and evaluated their perceived benefits of different learning and assessment tools near the end of the program. The survey results show that five out of 13 students have never produced a video before. Eight of them heard of “digital storytelling” but only three have done it before. Students compared digital storytelling with four other assessment tools in terms of their perceived effectiveness in reflecting the Germany experience, including writing a final paper, taking a final exam, doing a team project and making a final presentation. Digital storytelling was rated the most effective one among these assessment tools. Students also ranked seven different learning methods in helping them understand sustainable communities. The order from the most to least effective methods are: guided outdoor tours, host family (all students stayed with host families for the duration of the study abroad program), guided indoor tours, lectures in classroom, professional conference, interaction with classmates and personal tours. In conclusion, we found that current college students are capable of learning digital storytelling in a meaningful way and within a short period. Digital storytelling is a promising tool for reflecting study abroad experiences and is a suitable assessment tool in a study abroad setting, particularly for programs that are based on experiential learning strategies. We conclude the study by recommending to landscape architecture educators on how and when to use digital storytelling to facilitate deep learning in landscape architecture courses.*

---

The authors are solely responsible for the content of this technical presentation. The technical presentation does not necessarily reflect the official position of the Council of Educators in Landscape Architecture (CELA), and its printing and distribution does not constitute an endorsement of views which may be expressed. Technical presentations are not subject to the formal peer review process by CELA Track Chair System; therefore, they are not to be presented as peer-reviewed publications. Citation of this work should state that it is from a CELA conference paper. EXAMPLE: Author's Last Name, Initials. 2014. Title of Presentation. CELA Paper No. 14-xxxx. Baltimore, Maryland: CELA. For information about securing permission to reprint or reproduce a technical presentation, please contact CELA at dsolco@uta.edu or 817-272-2321.

### **1.1 Keywords**

study abroad, assessment, global education, experiential learning, high-impact learning

## **2 INTRODUCTION**

Digital storytelling is a short digital media production that allows ones to share their life story. It utilizes low-cost digital cameras, non-linear editing software and laptop computers to create short, multimedia stories (Meadows, 2003). Started by Joe Lambert and the late Dana Atchley in the late 1980s, digital storytelling “allows computer users to become creative storytellers through the traditional processes of selecting a topic, conducting some research, writing a script, and developing an interesting story” (Robin, 2008, p.222). Also defined by Davis (2004), a digital story is “a form of short narrative, usually a personal narrative told in the first person, presented as a short movie for display on a television or computer monitor or projected onto a screen.” Digital storytelling has gained popularity in higher education since the late 1990s in the US due to a great extent that media production techniques, hardware and software becoming much more accessible and affordable (McLellan, 2007; Center for Digital Storytelling, 2015).

In recent years, digital storytelling has been used to archive study abroad records and experiences in higher education. Such adoption of digital storytelling as a means for enhancing experiential learning may continue and become stronger because current higher education seeks for high-impact learning methods. According to Kuh (2008), study abroad is considered one of the high-impact educational practices in higher education because it brings the benefits of cultural exchange, global vision, diversity and so on. Also because study abroad takes place in a setting different from a typical classroom, assessment tools such as homework, exam and test may not be ideal. Although a study abroad experience can open a student’s mind and ignite one’s curiosity in learning about other cultures, it is through reflection that studying abroad can be explored more deeply (Clarke and Adam, 2011). Thus, digital storytelling is gaining attention for documenting study abroad experiences and is used as an assessment tool, as well as for performance measurement. Presently, some colleges and universities publish digital stories about study abroad online, including Beloit College, George Washington University, University of Denver, University of Minnesota, University of Wisconsin-Madison, etc.

Although digital storytelling is gaining much traction in higher education, research on its effectiveness in study abroad settings appears to be less visible. In the 2015 EDUCAUSE Learning Initiative annual conference, Melody Buckner (2015) of the University of Arizona presented a poster of a study titled “Digital Storytelling: As An Assessment Practice in Study Abroad Programs.” Buckner surveyed college students and collected their digital story artifacts to investigate two questions: 1) what effect does digital storytelling have on the learning experience of students and 2) what impact does digital storytelling have on demonstrating expected learning outcomes. Buckner (2015) concluded that digital storytelling is a good assessment for personal reflection but is light in academic rigor. While Buckner believed that digital storytelling’s reflective process enhances the learning experience, it cannot completely replace traditional assessment tools but is a good compliment. Todd (2013) investigated how well digital storytelling helped students return to their program after their study abroad experience. She found that reflection during study abroad re-entry is critical to ensuring learning outcomes, and digital storytelling is an effective medium for reflection. Todd (2013) suggested that critical reflection during re-entry would be more effective if it is incorporated into a course. Overall, digital storytelling has been evaluated on its effect on student learning outcomes. For example, Sadik (2008) evaluated Egyptian teachers in their application of digital storytelling in teaching and assess whether students were engaged in authentic learning tasks using digital storytelling. Sadik (2008) found that the digital storytelling projects could enhance students’

understanding of curricular content and teachers were willing to modify their pedagogy and curriculum to adopt digital storytelling. Similarly Smeda et al. (2014) investigated the pedagogical aspects of digital storytelling and the impact of digital storytelling on student learning in classrooms in an Australian school and found that digital storytelling is a powerful tool to integrate instructions with learning activities to stimulate more engaging and exciting learning environments.

The purpose of the study is to assess the effectiveness of digital storytelling as a reflection technique in the study abroad setting. In this paper, we introduce the process, result and evaluation of the application of digital storytelling on courses taught abroad. Because study abroad is an important or even required component in many landscape architecture programs, we conclude by recommending to landscape architecture educators on how and when to use digital storytelling to facilitate deep learning in landscape architecture courses.

### **3 PROCESS AND METHODS**

#### **3.1 Participants**

In summer 2015, 13 Texas A&M University (TAMU) undergraduate junior and senior students went to Germany to take credit-bearing courses about sustainable communities. Twelve out of the 13 students were in the general studies program with a concentration in architecture. One student was from the business major. For the general studies students, study abroad is required in their curriculum. Seven students were male; six female. Their age was low 20s. None of the students has done study abroad before.

#### **3.2 Study Abroad Arrangement**

The staff of the Academy for International Education (AIB) based in Bonn handled logistics, arranged tours/conference registration, and invited guest speakers while TAMU faculty delivered lectures in classroom and participated in all arranged activities by AIB. All students stayed with host families during the program. Only two were together with the same family; others were individually attended by host families. The AIB study center is located near the city center of Bonn. Each day students took public transportation (bus or train) from their host family's residence to the AIB study center. The commute time varied between 15 to 40 minutes. The entire program lasted five weeks. The first four weeks were in Bonn; the last in Berlin. When the entire group moved to Berlin, they stayed together in a hotel that week. During the regular work week, formal activities occurred from Monday to Thursday. Friday through Sunday were weekend. The program was relatively heavy on field trips in order to witness and experience sustainable practices in communities, in comparison to the time spent in the classroom at AIB.

#### **3.3 Learning Methods**

In a study abroad setting, learning should not be limited to the arranged activities in a classroom. The list below summarizes the various learning opportunities, intended and unintended, in the five-week program. For the purpose of this paper, we use them for discussion.

- Host family setting (casual, spontaneous, life-related, experiential)
- In-class educational lectures/discussion (purposeful)
- Guided outdoor field trips such as gardens, biking, canoeing, hiking, cities, etc. (purposeful, experiential)
- Guided indoor field trips such as museums, heating plant, waste management, etc. (purposeful, experiential)
- Attending a conference (2015 Resilient Cities, purposeful, experiential)

- Personal tours during weekends (casual)
- Interaction with classmates (casual or formal)

In addition, four assignments designed to facilitate learning sustainable communities were given to students. They are explained in the next section.

### **3.4 Assignments**

Assignment 1: sustainable host family. Students perform a sustainability assessment for the residence of the host family and create a narrative with illustrations, diagrams, photos of the systems in place. Students should interview the host family about how the five systems work, including transportation, energy, food, water and recycling. Students are to describe actions on a daily, weekly or monthly basis that demonstrate an attitude towards sustainable living in their host family's house. Expected length of this assignment is 5-7 pages with illustrations and 900-1,200 words.

Assignment 2: sustainable transportation. In this assignment, students document and map/illustrate the network of transportation methods that they can utilize to get from their host family home to AIB. Students should communicate the network of connections (by foot, by bicycle, by bus, tram, etc.) in which they move and compare with the single mode of movement that most of them utilize in Texas. Same expected length and format as Assignment 1.

Assignment 3: visual diary of social and physical components of sustainable practices. In this assignment, students should document AIB-arranged and any of their personal tours in a diary using a slide template. The template lists six categories to facilitate organization: urban agriculture, low impact development, walkable & bikeable communities, renewable energy, public and social places, and other sustainable practices.

Assignment 4: reflective digital storytelling video. In this assignment, each student creates a 3-minute video in which they must reflect on their learning before, during and after the 5-week living in Germany, and tell stories using their voice.

Prior to the trip, students were instructed to bring a laptop computer with video editing capabilities for the trip. After arriving Germany, students learned about digital storytelling, collected photos and video clips, and wrote a script for the video during the course period. At the end of the 4<sup>th</sup> week, students presented their rough cuts. After completing the program and returning to the US, students submitted their final videos. Required components of the video include:

- Still images (photos, sketches, screenshots, etc.)
- Motion pictures (recorded footages, borrowed films, animation, walk through animation, etc.)
- Narrative voiceover by the student (music is optional)
- Cite at least two of the assigned readings
- A page that lists all readings cited
- Credit and acknowledge page

During the video preparation stage, students used a storyboard to develop their video. Draft storyboards were submitted for instructor's review and comments. Students also wrote scripts for their stories and submitted drafts for review and comments.

### **3.5 Survey and Data Collection**

Students were surveyed at the end of the 4th week after rough cuts were screened to the entire group. Participants' background information such as gender, video production experience,

and understanding of digital storytelling was collected. Questionnaire of the survey included rating video-related tasks in terms of how helpful they were for reflecting the Germany experience, comparing digital storytelling with other assessment tools, and ranking different learning methods and assignments. Students could also provide comments on the overall learning experience.

## **4 RESULTS**

### **4.1 Participants' Digital Literacy**

All students brought a laptop computer to the trip and used them to complete the assignments. All but one student had video editing software installed in their computer. Five out of 13 students have never produced a video before the trip. For learning how to produce a video, two never learned; the other 11 students self-taught themselves. In terms of digital storytelling, eight students have heard of them before and only three have done digital storytelling before the trip. We provided light instruction on video editing and production in the beginning of the five weeks. All students were able to produce a video as required for Assignment 4. No one complained about learning video editing and production.

### **4.2 Effectiveness of Digital Storytelling**

Students rated various video-related preparation tasks on their effectiveness in helping them reflect the Germany experience. With the scale of 1 being very useful, 3 neutral and 5 not at all, all tasks were perceived helpful because the average scores were all less than 3 (neutral) (see Table 1). The most helpful task was reviewing visual materials such as photographs and videos students took during the trip, followed by draft storyboard and reviewing rough cuts with the group. Students appear to perceive reading the script they wrote less effective than any other tasks. Interestingly, students tend to prefer visual materials over writing and reading for reflecting the study abroad experience.

**Table 1.** Average rankings of video-related tasks in terms of how helpful they were for reflecting the Germany experience.

<b>Tasks</b>	<b>Average Score* (N = 13)</b>
Storyboard (1 <sup>st</sup> draft)	2
Storyboard (final)	2.54
Writing the script	2.46
Reading the script (voice over)	2.64
Reviewing the photos/videos taken during the trip	1.54
Relating the actual experience to assigned readings	2.36
Reviewing classmates' rough cuts	2

\*: 1-very helpful, 3-neutral, 5-not at all

Students were asked about other assessment methods' effectiveness in reflecting the Germany experience, including writing a paper, taking an exam, making a 10-minute final presentation or working on a team project followed by a final report. None of them was rated

more effective than digital storytelling for such reflection (see Table 2). Among all other assessment methods, taking an exam was the least favorite by students.

**Table 2.** Average scores of comparison between digital storytelling and other assessment methods in terms of their perceived effectiveness in reflecting the Germany experience.

<b>Assessment Methods</b>	<b>Average Score* (N = 13)</b>
Writing a paper	2.45
Taking an exam	2.64
Making a 10-min final presentation	2.25
Doing a team project and turning in a final report	2.45

\*: 1-better, 2-same, 3-worse

#### **4.3 Comparison of Learning Methods and Assignments**

Among the seven learning methods presented in Table 3, host family (2.85), guided outdoor field trips (2.69) and guided indoor field trips (3.54) were rated the most effective ones for understanding sustainable communities, followed by in-class lectures (5.62), attending a conference (6.69) and interaction with classmates (6.92). The result is reasonable because German families have lived more sustainably than Americans for a longer period of time. Our students living with them had the opportunity of witnessing the lifestyle and practiced it in person. Guided field trips (indoor or outdoor) were led by experts in respective subject areas and evidently have done a good job in delivering the sustainability message to the students.

Assignments were rated low, compared with the seven learning methods for understanding sustainable communities. Among the four assignments, Assignments 3 and 4 were rated lower than Assignments 1 and 2 (Table 3). This result confirms a known fact, that is, students do not like to be evaluated or “judged.” Because assignments are an assessment tool, students rated them low, in comparison with the seven learning methods that are all delivery tool. The result of the assignment rating could be attributed to the fact that Assignments 1 and 2 were simpler and due in just one week. Assignments 3 and 4 were comprehensive and had to cover the entire 5 weeks, which is much harder to complete.

**Table 3.** Average rankings of seven learning methods and four assignments in terms of how helpful they were for understanding sustainable communities.

<b>Methods or Assignments</b>	<b>Average Ranking*</b>	<b>SD</b>	<b>Highest</b>	<b>Lowest</b>
<b>Methods</b>				
Host family	2.85	1.99	1	6
In-class educational lectures/discussion	5.62	3.07	1	10
Guided outdoor field trips	2.69	1.89	1	7
Guided indoor field trips	3.54	2.11	1	8
International resilient cities conference	6.69	3.22	2	11
Personal tours during weekends	7.54	3.28	2	11
Interaction with classmates	6.92	3.20	3	11
<b>Assignments</b>				
Assignment 1 (host family summary)	5.92	2.27	2	10
Assignment 2 (sustainable transportation)	6.85	2.34	3	10
Assignment 3 (digital diary)	8.33	1.87	5	11
Assignment 4 (digital storytelling video)	8.23	1.83	5	11

\*: 1 represents the most helpful method; the larger the value, the lesser the helpfulness

#### **4.4 Written Comments Related to Digital Storytelling**

Overall, all students were satisfied with the courses. Excerpts of comments that are related to digital storytelling are listed below.

*"I think that by doing a visual diary and a video, I can remember what occurred in my time here. I think that this is the most valuable way for us to record and remember."*

*"So far I have enjoyed the projects. They made me aware of the local life. The papers and especially the video, I can watch in later in life and remember parts of the trip I might have forgotten."*

*"I would not make the class do the PowerPoint project, have them put all energy in the video diary. I think this was the most reflective and educational project."*

#### **5 CONCLUSION AND RECOMMENDATION**

This paper presents the result of the effectiveness of digital storytelling as a reflection technique in five-week study abroad teaching. The paper also includes the comparison result of learning methods and assignments for helping students understand an intended subject matter. Conclusions of the study include:

- Current college student's digital literacy is at a level ready or near ready for producing a short video.
- Digital storytelling is a promising tool for reflecting an experiential learning experience in an abroad setting.
- Reviewing visual materials help reflect on abroad experiences.
- Digital storytelling may facilitate deeper study abroad learning than traditional assessment tools such as writing a paper, taking an exam, making a final presentation or working on a team project with a required final report.
- Host family and guided field trips help students understand the sustainable practices the best.

These conclusions provide some guidance to landscape architecture educators because many landscape architecture programs embrace or require a study abroad experience. Moreover, the studio pedagogy deeply employed in landscape architecture education can benefit from what is learned from the experiment of digital storytelling used in this study. Our recommendations are an extension from the findings of the study beyond the study abroad setting.

- Integrate digital storytelling as a required component in courses that include experiential field learning. For example, service learning projects can be considered.
- Use experts to deliver lectures or guide field trips. If possible, require students to reflect on these activities using digital storytelling.
- Consider using digital storytelling for reflecting internship experiences. Internship has similar high-impact learning experiences as study abroad. Digital storytelling may be an effective tool for such reflection.

Finally, we encourage landscape architecture educators to experiment with digital storytelling in their teaching because, as Ohler (2006, p.47) stated, "creating a digital story taps skills and talents – in art, media production, storytelling, project development, and so on – that might otherwise lie dormant within many students but that will serve them well in school, at work, and in expressing themselves personally."

## **6 REFERENCES**

- Buckner, M., 2015. Digital storytelling: as an assessment practice in study abroad programs. Poster presented in the 2015 annual EDUCAUSE Learning Initiative (ELI) conference. Center for Digital Storytelling, 2015. How it all began. Accessed August 10.  
<http://storycenter.org/history/>
- Clarke, R., Adam, A., 2012. Digital storytelling in Australia: Academic perspectives and reflections. *Arts and Humanities in Higher Education: An International Journal of Theory, Research and Practice* 11(1-2), 157-176.
- Davis, A., 2004. Co-authoring identity: Digital storytelling in an urban middle school. *Technology, Humanities, Education, and Narrative* 1(1), 1-21.
- Kuh, G.D., 2008. *High-Impact Educational Practices: What They Are, Who Has Access to Them, and Why They Matter*, Association of American Colleges & Universities.
- McLellan, H., 2007. Digital storytelling in higher education. *Journal of Computing in Higher Education* 19(1), 65-79.
- Meadows, D., 2003. Digital storytelling: research-based practice in new media. *Visual Communication* 2(2), 189-193.
- Ohler, J., 2006. The world of digital storytelling. *Learning in the Digital Age* 63(4), 44-47.
- Robin, B.R., 2008. Digital storytelling: a powerful technology tool for the 21<sup>st</sup> century classroom. *Theory Into Practice* 47(3), 220-228.
- Sadik, A., 2008. Digital storytelling: a meaningful technology-integrated approach for engaged student learning. *Education Technology Research Development* 56, 487-506.
- Smeda, N., Dakich, E., Sharda, N., 2014. The effectiveness of digital storytelling in the classrooms: a comprehensive study. *Smart Learning Environments*, 1(6), 1-21.
- Todd, B., 2013. Study Abroad Re-entry: Critical Reflection through Digital Storytelling. *Master's Project Report*, Westminster College.





COUNCIL OF EDUCATORS  
IN LANDSCAPE ARCHITECTURE

**A CELA Conference Presentation**

**Paper Number: 14-xxxx (for CELA only)**

**Abstract ID: 27**

## **MAPPING CHANGES IN TOURIST ROUTES AS A TOOL FOR DESIGN: THE CASE OF BERLIN**

**FIDMAN, JANE,**  
Design Workshop  
[jfidman@gmail.com](mailto:jfidman@gmail.com)

### **1 ABSTRACT**

*The relationship between creative mapping and landscape architecture is one process by which thorough analysis of a particular site or city is conducted. Specifically, by mapping project areas in innovative ways, landscape designers are able to understand their sites in a unique light and become more imaginative in their approach to the design. This research argues the truth of the preceding statements while focusing on the specific example of mapping tourism in Berlin. Tourism, the author's interest, is studied specifically as an element that landscape architects have the potential to improve.*

*The questions that this research seeks to answer include how can landscape architects map and use tourist movement as an analysis tool for design? How have the walking routes recommended by travel guidebooks changed in Berlin over the past fifteen years? This study explores these questions by researching the patterns of tourism in Berlin since 1990 by mapping recommended walking paths from Lonely Planet and Rough Guides tourist guidebooks. While Berlin is researched in particular, the aim of this research is that the methodology used could be applied to other cities in order to assist in coming up with strategies to increase tourism for sites where that is one goal of the project.*

*The approach to this analysis includes a thorough literature review of academic theory of relevant subjects is undertaken. The subjects covered include: background information on Berlin, information on how tourism changes over time and a review of creative mapping and its impact on landscape architects. Furthermore, an analysis of the Tourist Route Project in Norway is included as a relevant example of how landscape architects can identify formerly touristic routes and rejuvenate them. Following the literature review, prescribed tourist routes for Berlin since 1990 (the year after the wall was destroyed) are mapped. Finally, the findings are compared to other sources.*

*After the synthesis of this research, conclusions are drawn as to how landscape architects, planners and related professions can use historical tourist data and its impact on urban development to influence the direction of future planning documents and projects. In the end, the study indicates that Berlin has become more centralized over time and there is room for landscape architects to revitalize formerly touristic paths that may have historic or economic value if improved.*

### **1.1 Keywords**

Mapping, Tourism, Visual Communication, Landscape Architecture, Urban Planning, Berlin

---

The authors are solely responsible for the content of this technical presentation. The technical presentation does not necessarily reflect the official position of the Council of Educators in Landscape Architecture (CELA), and its printing and distribution does not constitute an endorsement of views which may be expressed. Technical presentations are not subject to the formal peer review process by CELA Track Chair System; therefore, they are not to be presented as peer-reviewed publications. Citation of this work should state that it is from a CELA conference paper. EXAMPLE: Author's Last Name, Initials. 2014. Title of Presentation. CELA Paper No. 14-xxxx. Baltimore, Maryland: CELA. For information about securing permission to reprint or reproduce a technical presentation, please contact CELA at [dsolco@uta.edu](mailto:dsolco@uta.edu) or 817-272-2321.

## **2 INTRODUCTION**

Janike Larsen, an Associate Professor at the Institute of Urbanism and Landscape in Oslo, writes that “contemporary landscapes are invented by tourism” (Larsen, 2012). In other words, tourism has a huge impact on the development of a place. If this is true, how can landscape architects map and use tourist movement as an analysis tool for design? As a specific case study, how have the walking routes recommended by travel guidebooks changed in Berlin over the past fifteen years? In order to answer these questions, the main theme of creating mapping of tourism will be explored.

This study answers the research question with an extensive literature review, a test of creative mapping of Berlin and ends with comparisons to other findings on Berlin. More specifically, the literature review covers background information on Berlin and why it was chosen, an overview of creative mapping, information on tourist guidebooks and preferences and finally an example of a landscape architecture project which revitalizes a formerly touristic route. After the literature review, the maps of changing tourist routes from guidebooks about Berlin over the past fifteen years are presented. Finally, other maps related to tourism in Berlin are presented in order to compare the findings.

Overall, the aim of the research is to demonstrate that creative mapping techniques can be used to summarize information from tourist guidebooks over time. By doing so, a landscape architect or planner is able to see how a city, in this case Berlin, has changed. Furthermore, the maps can indicate which former tourist routes can be revitalized in the future. In the end, the research will show that creative mapping techniques can in fact be used to show how tourist routes change over time. For Berlin in particular, the maps show that the city is becoming more centralized and that some paths that were once recommended to tourists have now vanished from tourist guidebooks.

### **2.1 Limitations**

There are two limitations to note regarding this research. Firstly, only two guidebook publishers are used. Lonely Planet is regarded by bloggers as “the most popular guidebook series—especially with young, budget orientated travelers” (The Savvy Backpacker, 2011) and Rough Guides was chosen as the competitor. Each guidebook has been written by the same one to two authors throughout the entire time period of publication. Therefore it is important to note that the maps of guided walks reflect the opinion of a few people writing for a specific audience. Another limitation is that this method has only been tested on Berlin. Due to the permitted length of this research, it is not possible to compare findings from other cities. However, the idea of mapping recommended tourist routes over time should work for any other city and could be tested by another researcher.

## **3 LITERATURE REVIEW**

### **3.1 Berlin**

For this research, Berlin was specifically chosen as a case study for three key reasons. Firstly, the city has been in a state of transition since the fall of the Berlin Wall in 1989. Many buildings, roads, hotels, hospitals, parks and new tourist sites have been constructed since reunification (Hall, 2014). In November 2014, the 25th anniversary of the fall of the Berlin Wall was commemorated with lines of illuminated balloons marking where the wall once stood. The installation was necessary due to the fact that the once impenetrable wall is almost entirely erased from the city (Huggler, 2014). To sum up, Berlin is evolving very quickly. In fact, with all of the

changes that Berlin has managed in the past 25 years, Donald Watts notes that “the local populace are finding themselves tourists within their own city (Watts, 1998).” For this main reason, Berlin is a good choice for this study because it seemed more than likely that walking paths recommended for tourists would change as East and West Berlin merged together. Another reason for choosing Berlin for this research is that tourism is one of Berlin’s top industries. In the ranking of European tourist destinations, Berlin comes in third after London and Paris (European Cities Marketing, 2014). What makes Berlin the best choice for this research out of these three cities is the fact that it is much cheaper. For example, the average price of a hotel room in Berlin is just under half as much as that of a room in London (visitBerlin.com, 2011). Since Lonely Planet and Rough Guides are catered toward young tourists who are presumably budget-minded, Berlin was selected for this research for its high volume of tourism while still being affordable.

Finally, Berlin was chosen for its unique atmosphere of counter-culture, rebellion and gritty underground. As stated by travel writer Oliver Stallwood, “known for its relaxed atmosphere, cheap prices and hedonistic party scene, the German capital is a magnet for international creatives and layabouts” (Stallwood, 2012). While the classic David Bowie anthems of the seventies were inspired by Cold War Berlin, researchers such as Toby Rose claim that the “new Berlin” is as edgier as ever (Rose, 2013). However, with trendiness and waves of hipsters, there is a tendency for change. For example, gentrification is a serious problem and, in 2011, 6,000 people staged a peaceful march against the sky-rocketing rents of the Neukölln neighborhood (Stallwood, 2012). Therefore, in choosing Berlin, a city which is highly touristic and also in constant flux, the probability of creating interesting maps about city development is quite high.

### **3.2 Creative Mapping**

It is important to understand what creative mapping is, why it matters and how it can be used for analyzing tourism. Firstly, creative mapping combines conventional maps with additional information that isn’t normally found on typical cartography (Cosgrove, 1999). Generally, these kind of maps are done by designers who are trying to analyze a site creatively in order to gain inspiration for their final project. In fact, researcher Nadia Amoroso states that “creative mapping in many circumstances can be the precursor to strategically formulating the final design” and cites David Fletcher, an American landscape architect, as one practitioner that experiments with maps for design guidance (Amoroso, 2012).

In regards to why mapping of data matters, many researchers have already answered the question. As Nadia Amoroso states in her article *Creative Mapping*, “through mapping and the images resulting from this process, the designer can reveal a considerable amount of site information that is otherwise left ‘hidden’” (Amoroso, 2012). This means that representing data about the environment in visual graphics can lead designers to notice connections or information that would otherwise be much harder to find. To add to this sentiment further, James Corner wrote that the power of mapping “lies in neither reproduction nor imposition but rather in uncovering realities previously unseen or unimagined, even across seemingly exhausted grounds” (Cosgrove, 1999). In other words, a creative approach to mapping can unveil new information, even if it is regarding information that might seem simple, such as locations of parks within a city. If a creative approach is taken, new connections can be made in order to “layer” information. Layering means putting seemingly unrelated maps on top of each other in order to see similarities or new information. Corner favors creative mapping and layering over what he calls a “tracing,” which is when readily available cartographic information is merely copied (Cosgrove, 1999).

In conclusion, creative mapping is used by many landscape architects, including David Fletcher and James Corner. Practitioners use creative mapping techniques in order to find hidden connections or meaning through the process of layering. Therefore, this research is not arguing

the obvious point that landscape architects should map their environment. Instead, this research is specifically favors creative mapping of tourist routes in order to draw interesting conclusions.

### **3.3 Why Use Tourist Guides?**

In order to understand how creative mapping can be used for analyzing tourism, it is important to establish why tourist guidebooks have been chosen for this particular study. Of course, data on tourism can be mapped from a variety of other sources such as the number of visitors per year at different attractions or, as will be shown later in this research, locations of photographs taken by tourists compared to locals from Flickr data. While both examples would make interesting maps, visitors at attractions are not always tourists and many photos are impossible to decipher as uniquely tourist or local. Tourist guidebooks are specifically created for tourists and have been demonstrated to be used more than any other type of guide (Hanrahan and Krahenbuhl, 2012).

While this figure on guidebook usage is specific to Ireland and sources for Germany in particular could not be found, travel writers such as Paul Marshman note that “a good travel guidebook is still the best companion,” especially for their propensity to provide a lot of background information (Marshman, 2014). In other words, while there may be many travel websites or apps for tourists, guidebooks are still valuable and often used due to their ability to provide a lot of information in one convenient place.

### **3.4 Evolving Tourist Preferences**

An important aspect for landscape architects to note is that tourist preferences are constantly evolving. As Larsen notes, the “modern tourist seeks relief from an existential alienation and thus seeks the authentic in other cultures.” This means that tourists are presently looking to find natural and cultural sites that feel different from their own and distinctly represent the place that they are in (Larsen, 2012). Specifically, if this concept is applied to Berlin, tourists want to experience what they perceive to be local, to be German, to be uniquely Berliner. Larsen further notes that “commercialized tourism, then, risks losing authenticity, as the tourist becomes trapped in an encircling tourist-space” (Larsen, 2012). To put this more simply, when a city starts to heavily cater to tourists and an area becomes overrun by tourists, visitors will eventually lose the sense of experiencing something authentic.

In *The Concept of a Tourist Area Cycle of Evolution*, R.W. Butler explains how tourist preferences change in a similar way. Butler theorized that there are seven stages of tourism: exploration, involvement, development, consolidation, stagnation, decline and rejuvenation. To briefly explain, exploration is when there are few tourists in an area and no specific facilities for them. In involvement, new businesses catered to visitors crop up and demand for transit to the area occurs. Next, local businesses lose control over the development as big businesses such as hotel chains supersede and it becomes harder for locals to purchase property. This can also be described as the beginning of gentrification, though Butler does not use that exact word. In the following consolidation stage, there are more visitors than there are locals. Consolidation leads to stagnation, where the number of visitors is peaked and the destination is no longer fashionable. In decline, many formerly tourist places like hotels are bought back by locals as tourism is no longer as popular. New small businesses open and many buildings are converted into residential properties. Finally, rejuvenation may occur if new types of attractions are created in one of two ways. The first way includes new man-made attractions, which presumably could be a museum, though Butler uses a casino in Atlantic City as an example. The other type of attraction could be to “take advantage of a previously untapped resource” such as revitalizing slopes for skiing in the town of Aviemore in Scotland (Butler, 1980).

### **3.5 Landscape Architects and Tourism**

In researching tourist movement and specifically how landscape architects can track its changes as a tool for design, it is critical to find specific examples of how the profession contributes to tourism. In particular, the case study of The Tourist Route Project (TRP) in Norway is of interest as it is a good example of how formerly touristic routes can be revitalized by architects or landscape architects.

The TRP was developed by the National Public Roads Administration and is a series of 18 road sections throughout Norway in which interesting design and architecture interventions are placed to emphasize the landscape. This encourages tourist to drive on particular highways when exploring the fjords (Berre, 2010). As Janike Larsen states in her article *Global Tourism Practices as Living Heritage*, it “displays landscapes invented by tourism.” The interventions have been placed on sections of preexisting roads which were built between the 1880s and 1940s. (Larsen, 2012). In other words, the roads that were selected were formerly touristic but lost their appeal at a certain point. As previously described, there is a cycle to tourism and one of the stages is decline. According to R.W. Butler, one of the best ways to revitalize a touristic area in decline is to find ways to highlight nature (Butler, 1980). In the case of the TRP, touristic areas in decline were identified and were then rejuvenated by using architectonic interventions to allow visitors better access to majestic fjord views. This case study indicates that landscape architects can encourage tourism. The following chapters will expand on this sentiment but showing that tourism can be mapped over time in order to identify areas that could be revitalized in the future.

## **4 METHOD, FINDINGS & ANALYSIS**

### **4.1 Method**

The method for testing whether or not tourist routes have changed in Berlin included mapping recommended walking routes over time from Lonely Planet and Rough Guides tourist books. The Lonely Planet Berlin guides started to be published in 1998, while the 1st edition of Rough Guides Berlin was published in 1989. Due to availability of the books, maps for Lonely Planet are shown for the period between 2004-2013 and 1990-2014 for the Rough Guide series. Originally, the plan was to map the exact walking directions given in each guide over a period of fifteen years. However, upon beginning the process, it was clear that Rough Guides did not provide walking directions. Therefore, the approach was altered. For Lonely Planet books, the walking routes were mapped. For the Rough Guides, the order in which Berlin neighborhoods are presented throughout the book are mapped. These two different approaches, which are explained in further detail in the following sections, produced interesting results when compared against each other.

### **4.2 Findings: Lonely Planet**

For the analysis of the Lonely Planet guides, the recommended walking routes have been mapped. The following images represent the walking paths that were recommended for the first three days of visiting Berlin. Of note to landscape architects is that, over time, the routes have become shorter and closer together. This indicates that the city is becoming more centralized and that tourist preferences are changing. Furthermore, the fact that some of the recommended walks disappeared over time could mean that certain areas of Berlin are no longer fashionable and transitioned into residential neighborhoods, entering the decline phase that R.W. Butler described. In other words, the paths that are no longer recommended may have lost the ability to instill a sense of Larsen’s authenticity, which was also previously described in the literature review.

As previously mentioned, some of the walks disappeared over the years. Indeed, upon visiting Berlin and following the paths that are recommended in 1993, it is easy to see that Prenzlauer Berg, which is the northernmost walk depicted on the first map, seems more like a quiet residential area than a bustling tourist centre. The problem is that the once cheap, artsy area slowly gave way to gentrification and the displacement of lower-income people, like artists (Papen, 2012). Once the artists leave, it seems that the “authenticity” that tourists search for in Berlin in particular is no longer present. Therefore, while Prenzlauer Berg remains a wealthy suburb, it is no longer recommended in Lonely Planet as a walk worth visiting. This is a perfect example of an area that could be revitalized by landscape architects, for example, to encourage tourists to go back to visiting this area.





Fig 1 and 2: Walking paths suggested by Lonely Planet in 2004, 2014 (Schulte-Peevers, 2004, 2014)

#### 4.3 Findings: Rough Guides

The Rough Guides series are different from Lonely Planet in that they generally do not provide a set route to follow when exploring Berlin. Instead, the books are divided into chapters which provide advice on what to do in each area of the city. Therefore, these maps were produced in a slightly different way than the previous examples. Instead, these images represent the order of the first five chapters of the guides. Since 1990, there have been three distinct ways that the guides were arranged. In the oldest editions, the books were split into two sections: West and East Berlin. From 1995 to 2003, the guides broke the city into more distinct neighborhoods, but recommended that what they called “West Berlin” be visited first. Finally, from 2005-present, Rough Guides described the neighborhoods as smaller areas and recommended that Mitte, the German word for “centre,” be visited first. This indicates a shift towards more distinct areas of Berlin and a trend to centralization.

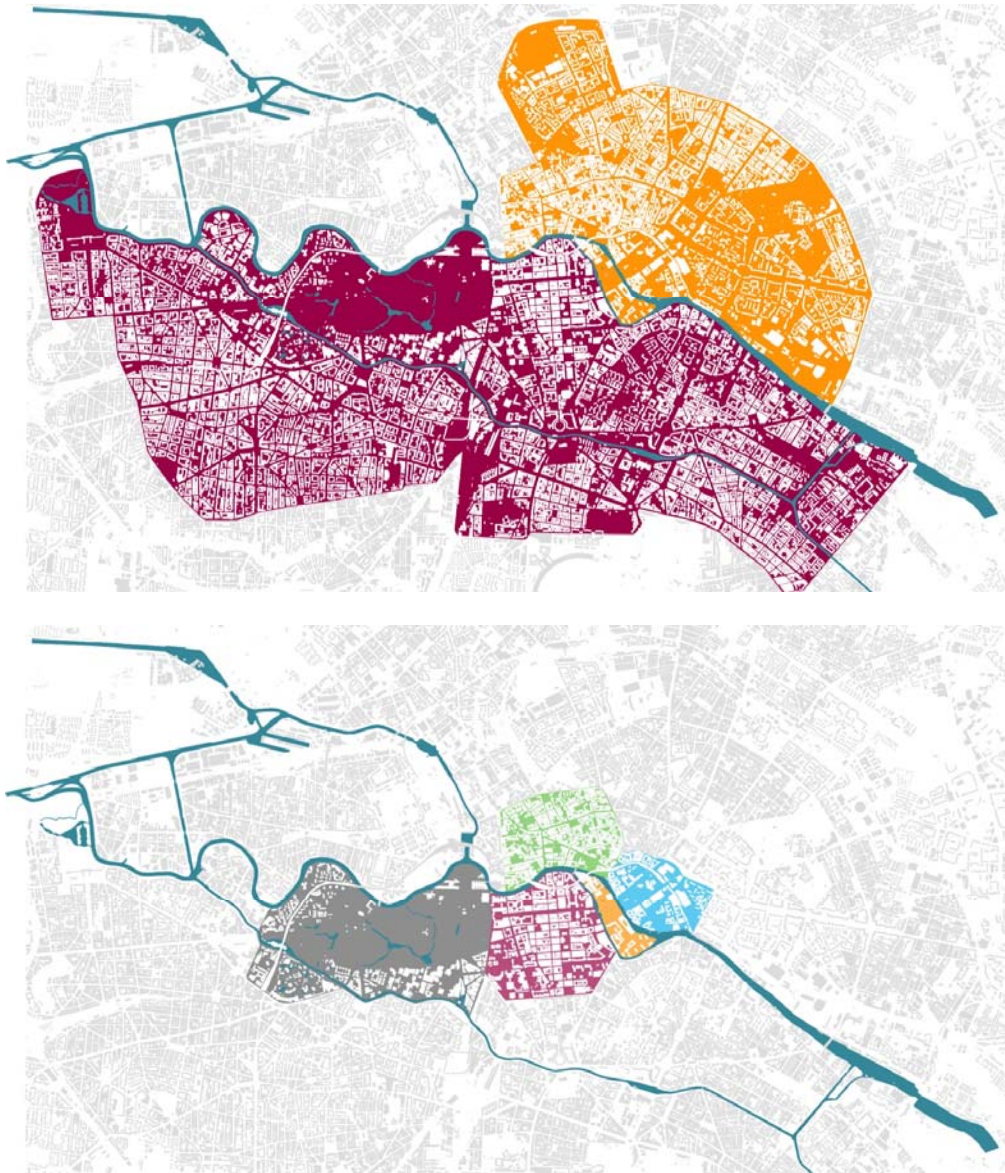


Fig 3 and 4: Neighborhoods to visit in 1990 and 2014 (Gawthrop, Holland, Sullivan and Williams, 1990-2014). The west, which once recommended to visit first is now the 5th area to see. Areas are smaller than first map. (Key: pink visit first, orange second, blue third, green fourth, grey fifth)

#### 4.4 Comparisons

Berlin is known to be a sprawling city. In fact, Berlin has a population of 3.5 million occupying an area of 900 square kilometers. In comparison, Paris has 2.15 million people in an area of 105 kilometers (Middentrop, n.d.). Therefore, the maps shown thus far have been showing that tourist routes can be found throughout many different neighborhoods. However, the city is becoming more centralized and, by comparing the maps created so far, it is easier to see the trend. The following maps show the comparisons between the Lonely Planet and Rough Guide books. When looking at the maps in combination, it is clear that Mitte is the first place that any visitor to Berlin should explore. Interestingly, Rough Guides start to favor Mitte in much earlier years than Lonely Planet. This could indicate the personal preferences of the authors of the guidebooks, for example.

#### 4.5 Supportive Findings

There are two other cases that specifically support the ideas that the city is becoming centralized for tourists, as well as the theory that visual mapping of tourist data can be useful as an analysis tool for landscape architects. Firstly, Eric Fischer created a map of Berlin which shows a visual representation of where tourists and locals take pictures of the city (Drapa, 2011). As can be seen below, the highest concentration of red (tourist) photos can be seen in the Mitte area of Berlin. As this map was created in 2010, it is aligned with the findings that the city is becoming more centralized as demonstrated by Lonely Planet and Rough Guides. Another interesting comment make about this map is that there is a huge overlap of where tourist and locals snap photographs. This is in contrast to other cities that Fischer has mapped, such as London or San Francisco, where there is a distinct tourist zone away from locals.



Fig 5: *Locals and Tourists #13 (GTWA #5): Berlin* (Fischer, 2010). Berlin's tourist and local areas

Secondly, the maps found on the Parcview portal from the city as mapped by the Federation of German Landscape Architects supports this research's findings (bdla, 2014). An



executive member of bdla, Christof Luz, when asked about the landscape of the city, notes that “the cultural and tourist-related potential produced by this interaction has been insufficiently exploited until now” (Landschaftsarchitektur-heute.de, 2014).

The goal of the Parcview portal from where the images are from is to introduce tourists and locals to more of the city’s parks and outdoor cultural spaces (Parcview.de, 2014). By analyzing these series of maps it is possible to see that the city is becoming more centralized partially because of the many landscape projects near the new centre of the city. Of course, many other factors can lead to the centralization of the city and as a part of the limitations of this research cannot be further explored here.

## **5 CONCLUSIONS**

There are three main aims of this research. Firstly, to show that creative mapping is useful for landscape architects. Many researchers and practitioners, such as James Corner, have already contributed to this field of research. As Eric Fischer states when asked about his Geotaggers World Atlas, “if you’re looking at a big table of numbers, it doesn’t tell you anything,” and proceeded to explain that visual mapping makes data more digestible (Drapa, 2011). Landscape architects in general can use creative mapping in order to find hidden connections and inspiration for their designs.

Secondly, this study aimed to demonstrate that creative mapping of tourism in particular is viable and useful because tourism does evolve. In particular, studying tourists guidebooks can be used to find formerly tourist routes that can be revitalized. Merely reading tourist guides or tourist data may not provide a full understanding of how a city has changed over time, especially for visual thinkers such as landscape architects. Therefore, it is useful to map the changes. The literature review showed there are two main ways that tourism has changed: the people currently seek authenticity instead of spectacle and that there is a cycle that tourism follows.

Finally, the goal of the research was to actually test the idea of mapping tourist routes over time in the case of Berlin. By studying the changes in recommended tourist routes in Berlin over time, the findings show that city has become more centralized for tourists. This means that some formerly tourist paths have perhaps become less appealing. With the aid of visual mapping, landscape architects can potentially find the places that were once attractions and reinvent them once again. For example, the Tourist Route Project in Norway showed how historically tourist routes could be reinvigorated with interventions to encourage new tourism.

In conclusion, creative mapping is certainly important for landscape architects and can be used to find hidden information about tourist trends in a city. In particular, mapping the changes of recommended tourist routes from guidebooks led to a series of interesting conclusions regarding Berlin. Landscape architects can use creative mapping to locate areas which were formerly touristic and possible reinvigorate them with new interventions such as what was done in Norway along the Tourist Route Project. In general, tourism follows a cycle and, during the revitalization stage, landscape architects have the unique opportunity to provide new attractions. Overall, the method led to the conclusion that Berlin is constantly evolving and becoming more centralized for tourists over time. Supportive research further reinforces this finding.

### **5.1 How the Research Can Be Continued**

While the aims of the research have been covered as best as possible considering the aforementioned limitations, there are still many questions that can lead to further research projects. An example of what could contribute to this research is experimenting with creating maps of recommended tourist routes from other publications which cater to different types of audiences. It would be interesting to see if the results are the same.

Another option would be to reach out to various landscape architects and inquire about how they approach projects that aim to promote tourism. There is little research currently available on how

specifically creative mapping has helped practitioners plan their approach to a tourism-related project. Perhaps firms such as James Corner Field Operations, whose owner wrote so much about mapping, may have further insight into the subject.

## 6 REFERENCES

- Amoroso, N. (2012). Creative mapping: architects have various approaches to collecting data at their disposal, which can be translated into a variety of exploratory and useful mapping techniques. *Canadian Architect*, 57(2), pp.39-42.
- bdla, (2014). *Berlin's Cultural Landscapes*. [image] Available at: <http://www.landschaftsarchitektur-heute.de/themen/berliner-kulturlandschaften> [Accessed 18 Nov. 2014].
- bdla, (2014). *Berlin's Wall Parks*. [image] Available at: <http://www.landschaftsarchitektur-heute.de/themen/berliner-kulturlandschaften/berliner-mauerstreifenparks> [Accessed 18 Nov. 2014].
- bdla, (2014). *Gardens of the Museums and Galleries in Berlin*. [image] Available at: <http://www.landschaftsarchitektur-heute.de/themen/berliner-kulturlandschaften/gaerten-der-museen-galerien> [Accessed 18 Nov. 2014].
- Berre, N. (2010). *Detour: Architecture and Design along 18 National Tourist Routes*. 1st ed. [ebook] Statens vegvesen, pp.9-26. Available at: <http://burgosciudad21.org/adftp/DETOURnet2.pdf> [Accessed 19 Dec. 2014].
- Butler, R. (1980). *A Tourism Area Cycle of Evolution*. [image] Available at: <http://aaronluman.com/articles/CycleOfEvolution.pdf> [Accessed 20 Dec. 2014].
- Butler, R. (1980). The Concept of a Tourist Area Cycle of Evolution: Implications for Management of Resources. *Canadian Geographer*, [online] 24(1), pp.5-12. Available at: <http://aaronluman.com/articles/CycleOfEvolution.pdf>.
- Cosgrove, D. (1999). *Mappings*. London: Reaktion Books, pp.213-252.
- Cox, A. and Ericson, M. (2007). *Travel Times on Commuter Rail*. [image] Available at: [http://www.nytimes.com/imagepages/2007/03/17/nyregion/nyregionspecial2/20070318\\_TR\\_AIN\\_GRAPHIC.html](http://www.nytimes.com/imagepages/2007/03/17/nyregion/nyregionspecial2/20070318_TR_AIN_GRAPHIC.html) [Accessed 20 Dec. 2014].
- Drapa, M. (2011). *Eric Fischer's Social Maps Show the World in a New Light*. [online] The University of Chicago. Available at: [http://www.uchicago.edu/features/20111017\\_fischer/](http://www.uchicago.edu/features/20111017_fischer/) [Accessed 8 Dec. 2014].
- European Cities Marketing, (2014). *ECM presents the results of Tourism in Europe through its Benchmarking report 2014*. [online] Available at: <http://www.europeancitiesmarketing.com/ecm-presents-results-tourism-europe-benchmarking-report-2014/> [Accessed 18 Dec. 2014].
- Fischer, E. (2010). *Locals and Tourists #3 (GTWA #4): San Francisco*. [image] Available at: <https://www.flickr.com/photos/walkingsf/4671581511/in/set-72157624209158632> [Accessed 20 Dec. 2014].

- Fischer, E. (2010). *Locals and Tourists #13 (GTWA #5): Berlin*. [image] Available at: <https://www.flickr.com/photos/walkingsf/4671578001/in/set-72157624209158632> [Accessed 25 Nov. 2015].
- Gawthrop, J. and Holland, J. (2001). *Berlin*. 6th ed. London: Rough Guides.
- Gawthrop, J. and Holland, J. (2005). *Berlin*. 7th ed. London: Rough Guides, pp.53-114.
- Gawthrop, J. and Williams, C. (2008). *Berlin*. 8th ed. London: Rough Guides, pp.45-116.
- Gawthrop, J. and Williams, C. (2011). *Berlin*. 9th ed. London: Rough Guides, pp.43-97.
- Hall, A. (2014). *Fall of the wall: How has Germany changed since the collapse of the Berlin Wall?*. [online] Sunday Express. Available at: <http://www.express.co.uk/news/history/530033/Germany-changed-collapse-Berlin-Wall-25-years> [Accessed 20 Dec. 2015].
- Hanrahan, J. and Krahenbuhl, P. (2012). *An Assessment of Tourist Demand and Use for travel guides: A focus on the use of new technology such as SMARTPHONES and download*. 1st ed. [ebook] Sligo: Failte Ireland, pp.7-19. Available at: [http://www.failteireland.ie/FailteIreland/media/WebsiteStructure/Documents/3\\_Research\\_Insights/4\\_Visitor\\_Insights/Assessment\\_of\\_Tourist\\_Use\\_for\\_travel\\_guides-Smartphone-Apps.pdf?ext=.pdf](http://www.failteireland.ie/FailteIreland/media/WebsiteStructure/Documents/3_Research_Insights/4_Visitor_Insights/Assessment_of_Tourist_Use_for_travel_guides-Smartphone-Apps.pdf?ext=.pdf) [Accessed 18 Dec. 2014].
- Hanrahan, J. and Krahenbuhl, P. (2012). *Types of travel guides used for Ireland*. [image] Available at: [http://www.failteireland.ie/FailteIreland/media/WebsiteStructure/Documents/3\\_Research\\_Insights/4\\_Visitor\\_Insights/Assessment\\_of\\_Tourist\\_Use\\_for\\_travel\\_guides-Smartphone-Apps.pdf?ext=.pdf](http://www.failteireland.ie/FailteIreland/media/WebsiteStructure/Documents/3_Research_Insights/4_Visitor_Insights/Assessment_of_Tourist_Use_for_travel_guides-Smartphone-Apps.pdf?ext=.pdf) [Accessed 20 Dec. 2015].
- Holland, J. (1990). *Berlin*. London: Harrap Columbus, pp.29-67, 129-161.
- Holland, J. and Gawthrop, J. (1992). *Berlin*. 3rd ed. London: Rough Guides, pp.39-84, 145-196.
- Holland, J. and Gawthrop, J. (1995). *Berlin*. 4th ed. London: Rough Guides, pp.70-144.
- Holland, J. and Gawthrop, J. (1998). *Berlin*. 5th ed. London: Rough Guides, pp.46-110.
- Huggler, J. (2014). *How Berlin has changed since the wall fell*. [online] Telegraph. Available at: <http://www.telegraph.co.uk/news/worldnews/europe/germany/11219265/How-Berlin-has-changed-since-the-wall-fell.html> [Accessed 20 Dec. 2014].
- Huggler, J. (2014). *Schöneberg after the fall of the Berlin wall*. [image] Available at: <http://www.telegraph.co.uk/news/worldnews/europe/germany/11219265/How-Berlin-has-changed-since-the-wall-fell.html> [Accessed 20 Dec. 2015].
- Huggler, J. (2014). *Schöneberg before fall of the Berlin Wall*. [image] Available at: <http://www.telegraph.co.uk/news/worldnews/europe/germany/11219265/How-Berlin-has-changed-since-the-wall-fell.html> [Accessed 20 Dec. 2014].
- Landschaftsarchitektur-heute.de, (2014). *Landschaftsarchitektur heute*. [online] Available at: <http://www.landschaftsarchitektur-heute.de/themen/berliner-kulturlandschaften/berliner-mauerstreifenparks> [Accessed 24 Nov. 2014].

- Larsen, J. (2012). Global Tourism Practices as Living Heritage: Viewing the Norwegian Tourist Route Project. *Future Anterior*, [online] 9(1), pp.66-87. Available at: [http://muse.jhu.edu/journals/future\\_anterior/v009/9.1.larsen.html](http://muse.jhu.edu/journals/future_anterior/v009/9.1.larsen.html) [Accessed 18 Dec. 2014].
- Marshman, P. (2014). *Why a travel guidebook is the best companion*. [online] The Traveling Boomer. Available at: <http://travellingboomer.com/travel-guidebook-still-best-companion/> [Accessed 15 Dec. 2014].
- Middendorp, J. (n.d.). Berlin. *Eye Magazine*, (74/09), pp.34-36.
- Papen, U. (2012). Commercial discourses, gentrification and citizens protest: The linguistic landscape of Prenzlauer Berg, Berlin. *Journal of Sociolinguistics*, 16(1), pp.56-80.
- Parcview.de, (2014). *ParcView*. [online] Available at: <http://www.parcview.de/> [Accessed 24 Nov. 2014].
- Rose, T. (2013). Edgy Berlin is the euro winner attracting the cool crowd. *Evening Standard*, [online] pp.12-14. Available at: <http://www.homesandproperty.co.uk/property-news/holiday-homes/edgy-berlin-euro-winner-attracting-cool-crowd> [Accessed 18 Dec. 2014].
- Schulte-Peevers, A. (2007). *Berlin encounter*. Footscray: Lonely Planet, pp.31-40.
- Schulte-Peevers, A. (2010). *Berlin*. 2nd ed. Footscray, Vic.: Lonely Planet.
- Schulte-Peevers, A. (2011). *Berlin*. 7th ed. Footscray, Vic.: Lonely Planet, pp.70-74.
- Schulte-Peevers, A. (2013). *Berlin*. 8th ed. Footscray, Vic.: Lonely Planet, pp.16-18.
- Schulte-Peevers, A. and Parkinson, T. (2004). *Berlin*. 4th ed. Footscray, Vic.: Lonely Planet, pp.149-160.
- Stallwood, O. (2012). *How Berlin is fighting back against growing anti-tourist feeling in the city*. [online] The Guardian. Available at: <http://www.theguardian.com/travel/2012/dec/04/berlin-fights-anti-hipster-tourism-abuse> [Accessed 18 Dec. 2014].
- Sullivan, P. (2012). *Pocket Rough Guide Berlin*. London: Rough Guides.
- Sullivan, P. (2014). *Pocket Rough Guide Berlin*. 2nd ed.
- The Savvy Backpacker, (2011). *The Best Travel Guides For Budget Travelers: Travel Guidebooks, Online Travel Guides & More*. [online] Available at: <http://thesavvybackpacker.com/best-travel-guides-europe-budget-travelers-guidebooks-online-guides/> [Accessed 20 Dec. 2014].
- visitBerlin.com, (2011). *Economic Factor for Berlin: Tourism and Convention Industry*. [online] Berlin: European Commission, pp.2-25. Available at: <http://press.visitberlin.de/sites/default/files/economic-factor-for-berlin.pdf> [Accessed 16 Dec. 2014].
- Watts, D. (1998). Tourism of Development and Development of Tourism: Potsdamer Platz, Berlin. *Traditional Dwellings and Settlements Review*, [online] 10(1), pp.22-24. Available at: <http://www.jstor.org/stable/41757427>. [Accessed 23 Dec. 2014].
- Williams, C. (2014). *Berlin*. 10th ed. London: Rough Guides, pp.34-89.

**Bio**

Jane is a landscape designer and urban planner in Design Workshop's Austin office. In May 2015 she completed an MLA at the University of Edinburgh in Scotland where she conducted her research on creative mapping. She also studied Economics as an undergraduate in Chicago and in Finland before pursuing her passion for design.

Prior to working at Design Workshop, Jane completed an internship at an internationally known landscape architecture firm, Latz + Partner, in Germany. Now, she is interested in continuing her research on creative mapping and is also interested in memorial landscapes.

## CREATING OUTDOOR PLAY ENVIRONMENTS WHICH SUPPORT THE SOCIAL INTERACTIONS OF CHILDREN WITH AUTISM SPECTRUM DISORDER

**CHRISTENSEN, KEITH M.**

Landscape Architecture and Environmental Planning, Utah State University, [keith.christensen@usu.edu](mailto:keith.christensen@usu.edu)

**ROMERO, LAURA PATRICIA REYES**

Landscape Architecture and Environmental Planning, Utah State University, [laurareyes29@gmail.com](mailto:laurareyes29@gmail.com)

### 1 ABSTRACT

*Autism Spectrum Disorder (ASD) is a developmental disorder characterized by impairments in social interaction and gestural communication. Various play-based interventions have been used to help children with autism develop social skills, including direct teaching strategies. Interventions that consider how children play instead of the final outcome of the play session seem to be more effective in addressing each child's needs, but because children with autism display a large range of variability the results of play interventions are usually very unpredictable. Research suggests that play environments for children with ASD need to be structured in order to be effective. In the absence of well-structured environments structured teaching strategies are often used. However, well-designed outdoor play environments may provide the necessary structure to support social interactions, creating an important place where children with ASD can learn social skills through play. Yet there is little understanding of the design of outdoor play environments which support the social skills development of children with ASD.*

*The purpose of this study is to examine evidence-based outdoor play environment design strategies which support the social skills development of children with ASD.*

*To do so, a review of the literature involving children with ASD, outdoor play environments, and social skill development was conducted. Google Scholar and EBSCOHost were the main electronic databases searched. While the original study intent was to identify and document empirically based studies of children with ASD's play behavior in outdoor environments, it quickly became apparent that there is an absence of support for empirical evidence-based design strategies supporting these behaviors. As a result, the focus evolved to developing best practices for the design of outdoor play environments by identifying the atypical play behaviors of children with ASD. The numerous studies examining the play behaviors of children with ASD can be categorized into four primary areas of impacted development: low motor skills and coordination, sensory integration, generative play, and joint attention. This presentation, and accompanying paper, will present related studies describing the impact of characteristics of the environment on low motor skills and coordination, sensory integration, generative play, and joint attention.*

*Addressing these four play behaviors in the design of the outdoor play environments likely plays an important role in creating spontaneous and pleasurable play opportunities for children with ASD, and may well support social interactions, creating an important place where children with ASD can develop social skills through play.*

### 1.1 Keywords

play, autism spectrum disorder, social interaction

## 2 INTRODUCTION

Play is a spontaneous, pleasurable and enjoyable act, which has no goal imposed from the outside (Garvey 1977; Jordan 2003; Mastrangelo 2009; Wolfberg and Schuler 1993). Yet, play is a crucial part of childhood promoting cognitive, physical, social and emotional well-being (Ginsburg 2007). Through play children learn to develop more complex functions and gradually master their behaviors and acquire social skills (Tsao 2002). Play is particularly important for social skills development.

Autism Spectrum Disorder (ASD) is a developmental disorder characterized by impairments in social interaction and gestural communication (Baron-Cohen Leslie, and Frith 1985; Ingersoll and Schreibman 2006). Even though children with ASD display a large range of variability in intellectual functioning they are usually characterized by repetitive and stereotyped behavior, verbal delays, aggressive or self-injurious behavior, obsessive routines and rituals, fear of change in the environment, and atypical responses to sensory stimuli (Folstein and Rosen-Sheidley 2001; Gillot, Furniss, and Walter 2001; Mastrangelo 2009). In addition, deficits in reciprocal social interaction and communication in children with ASD create special challenges in initiating and maintaining play as the children are usually unable to relate to others and understand social cues (Jordan 2003; Bruinsma, Koegel, and Koegel 2004; Mastrangelo 2009).

Various play-based interventions have been used to help children with autism develop social skills. Interventions considering how children play instead of the final outcome of the play session seem to be more effective in addressing each child's needs, but because children with autism display a large range of variability the results of play interventions are usually very unpredictable (Bass and Mulick 2007; Mastrangelo 2009). Therefore, applying a multiple method approach appears to be the most effective way to support play behavior for children with autism spectrum disorder.

Mastrangelo (2009) describes two general play-based intervention approaches used for children with ASD's social skill development; a behavioral approach focuses on structured interventions that rely on behavioral principles for learning, and a developmental approach that emphasizes child-led interactions. Highly structured behavioral-based interventions have been proven effective in addressing social interaction among children with ASD (Brock et al., 2006; National Research Council, 2001). At the same time, the developmental approach is preferred for greater flexibility in play choices based on the child's strengths and areas of interest, as well as being most in keeping with play as a spontaneous, internally driven act. Proponents of the development approach contend that the developmental approach encourages natural, spontaneous social interactions (Greenspan and Wieder 2006, 2007; Lu et al., 2010).

Child-led play behavior in young children are particularly influenced by the design of the play environment (Barbour 1999; Bowers 1988). The environment is capable of providing functional play experiences by offering developmentally appropriate challenges that support spontaneous play (Bowers 1988; Frost 1988; Beckwith 1988). According to Frost (1988) a developmentally oriented playground "should include space, materials, equipment and activities to enhance, enrich, and encourage all the forms or processes of play appropriate to the age or developmental levels of the children involved." Outdoor play environments, which are developmentally appropriate, help support social skills development by providing a child-led play environment (Barbour 1999; Bowers 1988; Frost 1988).

Research suggested that play environments for children with ASD need to be structured in order to be effective (Mastrangelo 2009; Wolfberg and Schuler 1993). Well-designed outdoor play environments may provide the necessary structure to support social interactions, creating an important place where children with ASD can learn social skills through play (Burdette and

Whitaker 2005; Menear, Smith, and Lanier 2006). Yet there is little understanding of the design of outdoor play environments which support the social skills development of children with ASD (Yuill, Strieth, Roake, Aspden and Todd 2007).

### **3 PURPOSE**

The purpose of this study is to examine evidence-based outdoor play environment design strategies which support the social skills development of children with ASD. To do so, a review of the literature involving children with ASD, outdoor play environments, and social skill development was conducted. Google Scholar and EBSCOHost were the main electronic databases searched. The search terms evolved to reflect those found throughout the review process, and included: autism, play, social interaction, social skills, outdoor play environment, playground, low motor skills, coordination, sensory integration, generative play, and joint attention.

The original study intent was to identify and document empirically based studies of children with ASD's play behavior in outdoor environments. It quickly became apparent that there is an absence of support for empirical evidence-based design strategies supporting these behaviors. As a result, the focus evolved to developing best practices for the design of outdoor play environments by identifying the atypical play behaviors of children with ASD, with related studies describing the impact of characteristics of the environment on the identified behaviors. The information identified is presented hereafter, to help establish best practices in the design of outdoor play environments which support the social skills development of children with ASD.

### **4 ASD PLAY BEHAVIORS**

Numerous studies examine the play behaviors of children with ASD. The numerous studies examining the play behaviors of children with ASD can be categorized into four primary areas of impacted development: low motor skills and coordination, sensory integration, generative play, and joint attention.

#### **4.1 Low Motor Skills and Coordination**

Underdeveloped eye-hand and speech coordination, difficulty with balance and other motor impairments, create barriers for the development of social skills in children with ASD (Green et al. 2009; Menear et al. 2006; Folstein and Rosen-Sheidley 2001; Leary and Hill 1996). It is believed that these difficulties in communicating ideas through speech and awkward physical behavior create isolation (social exclusion) from typical developing children (Wolfberg and Schuler 1993; Bass and Mulick 2007). Low muscle strength can greatly affect their play opportunities as children might be unable to perform simple tasks as throwing a ball or running (Menear et al. 2006; Hilton, Zhang, Whilte, Kloth, and Constantino 2012). Therefore, outdoor play environments emphasizing physical play or a particular age level may be detrimental by not offering an appropriate level of physical challenge to children with ASD (Naber et al. 2008).

#### **4.2 Sensory Integration**

Children with ASD present atypical responses to sensory stimuli, which intensify their structured and stereotyped behavior (Dawson and Watling 2000). The need for visual boundaries, diminished response to potential hazards, and a preference for exploration through touch, taste and smell versus visual and auditory cues affect play opportunities for children with ASD (Menear et al. 2006; Naber et al. 2008).



### 4.3 Generative Play

Children with ASD generally exhibit frustration in the generation of spontaneous play, which tends to create detachment and lack of motivation in their social engagement (Mastrangelo 2009; Jordan 2003). Unstructured play environments impact children with ASD's ability to initiate play with peers, as they increase confusion in the generation of play ideas and development of theory of mind skills (Meneer et al. 2006; Mastrangelo 2009; Libby, Powell, Messer, and Jordan 1998), creating a deficit in metarepresentation and symbolic play (Libby et al. 1998; Mastrangelo 2009).

### 4.4 Joint Attention

Observed as difficulty making eye contact, children with ASD exhibit impairments in establishing joint attention, which results in slower development of social skills through play (Jordan 2003; Bass and Mulick 2007). The reciprocal nature of social interaction creates positive affects in joint attention among typically developing children, compared to neutral affect in children with ASD (Jordan 2003; Bruinsma et al. 2004). These affects can impact the generation of social relationships as typically developing children may feel ignored, thus developing social exclusion towards the child with ASD (Jordan 2003). Social exclusion leads to solitary play and thereby to failure developing and practicing social skills (Jordan 2003).

## 5 DESIGN CONSIDERATIONS

The characteristics of outdoor play environments will affect the play behavior of children with ASD. In order to create effective outdoor play areas that contribute to the social skills development of children with ASD, outdoor play environments should be structured to appropriately address low motor skills and coordination, sensory integration, generative play, and joint attention. The following discussion represents guidance on how these play behaviors may be influenced by the structure of the outdoor play environment.

### 5.1 Low Motor Skills and Coordination

Outdoor play environments are an optimal place where children can practice and develop motor skills (Fjørtoft 2001). The design of the play environment and the inclusion of developmentally appropriate activities can influence motor skills acquisition in young children (Barbour 1999). Children with ASD, who are hesitant to engage in physical activity and/or engage in less physical activity than their peers without disabilities (Pan and Frey 2006), face self-imposed isolation limiting opportunities for interactions and social skill practice. The following elements may be used in outdoor play environments to support motor skills and coordination development meeting the needs of children with ASD.

**5.1.1 Movement.** Motor planning activities such as climbing, dancing, running, jumping, hopping, and sliding help children develop core strength and coordination skills, while helping regulate their nervous system (Bowers 1988). The act of walking on stepping stones, low beams, or uneven surfaces, as well as navigating obstacles of rocks, logs, or play equipment, are more accessible motor planning opportunities and may help children with ASD develop coordination and balance while strengthening their upper and lower extremities. Indeed, these types of repetitive activities may be attractive to children with ASD (Honey, Leekam, Turner, and McConachie 2006; Folstein and Rosen-Sheidley 2001; Mastrangelo 2009)

**5.1.2 Swinging.** The rhythmic, slow, full body vestibular stimulation of swinging can have a calming effect. This type of vestibular stimulation is much more accessible to children who are

hypersensitive to movement, while simultaneously decreasing hyper-reactive responses to sensory input. In addition, swinging may help develop sequencing and motor coordination skill development, which is often delayed in children with ASD. Swinging is the most important vestibular experience an outdoor play environment should afford for children with ASD.

Seesaws, and other similar activities, may also provide opportunities to access similar vestibular stimulation, in addition to requiring cooperation with another, thereby increasing opportunities for social interaction.

**5.1.3 Loose Parts.** According to Nicholson's Theory of Loose Parts (1971), movable parts empower creativity. Loose parts become anything the child wants them to be, extending existing forms of play and providing opportunities for cooperative play (Frost 1988; Barbour 1999). Loose parts such as sand, water, blocks, containers, garden tools, mechanical tools, and sports equipment, offer multiple combinations and immeasurable scenarios for varied play experiences (Frost 1988). Loose parts support unstructured play which can influence children to experience new sensory stimuli and learn to respond appropriately (Bowers, 1988). Loose parts may also be used to augment structured play settings. In doing so both the structure to guide the play of children with ASD and the child-led opportunities supporting creative and cooperative play are available to children with ASD.

Outdoor play environments serve an important role in the development of motor skills and coordination, which prepares children for cooperative play. Understanding that children develop motor skills at their own pace is essential when designing developmentally appropriate outdoor play environments. As a result, there needs to be a continuum of developmentally appropriate opportunities for motor skill development to meet the diverse needs of children with ASD. Appropriate opportunities for vestibular and proprioceptive stimulation create opportunities for social skill practice.

## **5.2 Sensory Integration**

Sensory processing disorders are relatively common among individuals with ASD (Dawson and Watling 2000; Harrison and Hare 2004; Myles, Cook, Miller, Rinner, and Robbins 2000; Volkmar, Cohen, and Paul 1986). In general, children with ASD present varying responses to sensory stimuli (Adamson, O'Hare, and Graham 2006; Kern, Garver, Grannemann, Trivedi, Carmody, Andrews, and Mehta, 2007; Kern, Garver, Carmody, Andrews, Mehta, and Trivedi 2008; Lane, Young, Baker, and Angley 2010; Leekam, Nieto, Libby, Wing, and Gould 2007). Sensory integration can contribute to the reduction of rigid and stereotyped behavior in children with ASD (Dawson and Watling 2000). The following opportunities in outdoor play environments may be instrumental in the integration of various sensory stimuli.

**5.2.1 Structure.** Children with autism benefit from structured environments (Jordan 2003). Structure helps emphasize where and how activities are to take place, thereby contributing to reduced stress, anxiety, and behavioral problems in children with ASD by making things predictable (Gillot et al. 2001). Outdoor play environments provide children with ASD with the necessary structure to carry out play activities in a typical manner, reducing conflicts and misperceptions with typically developing children (Thomas and Smith 2004). Thus, greater opportunities for social interaction.

**5.2.2 Visual Boundary.** Unlike typically developing children, children with ASD do not generally segment their environment, making it difficult for them to understand what is to occur in large open areas (Mostafa 2008). Clear physical and visual boundaries, such as fences, paths, and changes in texture or planting, can help children with ASD to understand where each area of the play environment begins and ends (Mostafa 2008), in essence increasing the recognizable structure of the play environment. Further, clear boundaries assist children with ASD in

understanding the social boundaries of play in the area, when the two are designed to correspond.

**5.2.3 Sensory Stimuli.** Children with ASD are much more likely to demonstrate unusual responses to sensory stimuli than typically developing children (Adrien, Ornitz, Barthelemy, Sauvage, and Lelord 1987; Kern et al. 2008; Ornitz 1983), particularly hyporesponsiveness characterized by the absence of the expected response to a stimulus (Watson et al. 2011). Hyporesponsiveness is associated with the appearance of passivity and disengagement (Watson et al. 2011), which understandably has a negative impact on social interaction. Children with ASD may benefit from strong multi-sensory landmarks and activities which will attract the shared attention of all children. In order to engage their senses, sensory cues need to be organized clearly to reduce overstimulation of the child. This can be achieved by clear boundaries and consistent patterns of color, tone, texture, and sound that help define specific areas where particular activities are to occur. Within these areas of sensory consistency, a multi-sensory landmark may be used to focus shared attention between children with ASD and their typically developing peers.

Opportunities to pace and regulate sensory stimulation should be available within the play environment, preferably in close proximity to active areas. These spaces may be child-scaled and partially enclosed.

**5.2.4 Sand Play.** Research suggests that sand play, when combined with loose parts to support symbolic play, provides multi-layered support for sensory play including social expression (Lu et al., 2010). For children with ASD, the evidence suggests that sand play opportunities provide enough structure to support the development of socialization skills (Lu et al., 2010).

Sensory integration in the play environment can help children with ASD to increase alertness, success and productivity, by providing cues that help them construct appropriate, meaningful responses to stimuli.

## **5.3 GENERATIVE PLAY**

Generativity is vital for social skills development in young children. Children with ASD may have difficulty in initiating pretend play because of impairments in the generation of play ideas (Jarrold, Boucher, and Smith 1996). Particular elements of the play environment can help support generative play for children with ASD.

**5.3.1 Defined Areas for Socialization.** Children with autism have difficulty understanding physical space communication (Arnaiz Sanchez, Segado Vasquez, and Albaladejo Serrano 2011). They are particularly susceptible to the development of proxemics which might lead them to feel threatened by unexpected social intrusion (Jordan 2003). Areas where socialization is expected should be designed to bring children together in cooperative types of activities with clearly defined space for each participant. Including clear physical and visual boundaries, as well as play cues, can help reduce distress caused by social interaction in children with ASD (Jordan 2003; Arnaiz Sanchez et al. 2011). Doing so allows children with ASD to enlarge their intimate zone and comfortably increase peer interaction and dramatic play (Jordan 2003).

**5.3.2 Play Cues.** The lack of play signals is one of the major inhibitors of social interaction in children with autism (Jordan 2003). Studies show that young children with autism are capable of producing pretend play and generating play ideas when prompted with play cues (Lewis and Boucher 1995). The design of the outdoor play environments may provide these play cues, as prompts to engage in appropriate play. Gentle themes that are not too prescriptive are ideal to provide children with cues while not limiting their creative play. Abstraction in outdoor play

environment design is not beneficial due to the unclear play cues which may be confusing, particularly given children with ASD's impairments in play generativity.

**5.3.3 Music.** Studies have shown that music therapy reduces self-stimulation and encourages self-expression in children with ASD (Stephens 2008; Kern and Aldridge 2006). Reducing self-stimulation increases spontaneous play among children with ASD (Koegel, Firestone, Kramme, and Dunlap 1974). A musical center becomes a place in which children of all abilities are able to participate. That no specific outcome is expected reduces anxiety and frustration in children with ASD.

Providing the necessary structure and play cues may increase children with ASD's ability to generate play ideas and engage in spontaneous play (Jarrold et al. 1996; Lewis et al. 1995). The structure of the play environment plays an essential role in promoting pretend play and thereby increasing peer interaction in children with ASD.

## **5.4 JOINT ATTENTION**

Mundy (1997) defines joint-attention as "the use of gestural acts to direct attention in order to share the experience of an object with another person." Eye contact, smiles and gestures provide people with the ability to interact with others nonverbally. Children with ASD may be less able to share attention because deficits in the generation of a theory of mind create impairments in the development of their social abilities (Baron-Cohen et al. 1985; Mundy and Crowson 1997; Kasari, Freeman, and Paparella 2006; Jarrold et al. 1996). Even though there is little literature investigating joint attention in play activity, different type of stimuli may be included in outdoor play environments to promote joint attention in children with ASD.

**5.4.1 Parallel and Cooperative Play.** Providing comfortable opportunities for parallel play, where eye contact can be easily made, is beneficial in fostering social interaction. Over time, play activities can become more cooperative and include taking turns, sharing materials or emotional expression which will promote the generation of play ideas and allow the children to share a common focus (Yang, Wolfberg, Wu, and Hwu 2003).

**5.4.2 Low Degree of Concentration.** Children with ASD have clear attention and concentration impairments (Patten and Watson 2011). Play activities that do not require a high degree of concentration can be beneficial in allowing children with ASD to produce functional play and interact with others simultaneously. Activities that require low physical effort and encourage the use of natural body positions can make shared play experiences more enjoyable for children with ASD.

**5.4.3 Visual Scripts.** Studies have shown that children with ASD are able to engage in functional play when they are taught specifically how to play with a certain toy (Thomas and Smith 2004; Wolfberg and Schuler 1999). Play scripts can contribute to the structured development of play skills in children with ASD (Thomas and Smith 2004; Rogers 2000). Visual scripts can take the form of graphic cues that will prompt the child on how to play with a specific piece of equipment, without being too prescriptive to leave room for the development of their own play ideas. Appropriate play structured by the use of play scripts can assist children with ASD in appropriately playing with typically developing children, thus promoting cooperative play and social interaction (Thomas and Smith 2004). The use of visual scripts is expected to vanish overtime as the child has learned and mastered the expected behavior (Rogers 2000).

**5.4.4 Imitation.** Imitating play behavior teaches children with ASD the benefits of shared attention and social interaction (Stephens 2008). Promoting play areas in which reciprocal imitation is encouraged (a seesaw for example) will allow children with ASD to socially interact with others.

The social nature of joint attention makes it a crucial element that needs to be addressed in outdoor play environments. By taking into consideration the elements listed above, children with ASD can learn to enjoy the benefits of sharing a common focus, an essential aspect in the development of their social abilities.

## **6 SUMMARY**

Play is important for social skills development in children with ASD. As individual manifestations in children with ASD vary greatly, different methods are necessary to guide social interaction through outdoor play environments. The design of the environment can determine the success or failure of a playground in supporting social interactions for young children with ASD. While there is little empirical evidence on specific design strategies to support social skills development in outdoor play environments for children with ASD, there is a body of support to suggest best practices addressing the four primary areas of play deficits among children with ASD: low motor skills and coordination, sensory integration, generative play, and joint attention. Supporting social interaction among children with ASD may be supported by analyzing the impact of specific design elements on the identified behaviors.

Design opportunities may include easily accessible motor planning activities which may help children with ASD improve their balance and coordination. Other activities such as swinging can have a calming effect for children with ASD who are often hypersensitive to movement. The use of loose parts in structured areas of the play environment provides unstructured play within a structured environment, which promotes creative and imaginative play.

A structured play environment in which sensory cues are clearly organized can help reduce overstimulation in children with ASD. This along with the implementation of clear physical and visual boundaries can contribute to addressing sensory integration deficits.

The use of gentle themes as “play cues” can contribute to the generation of play ideas in children with ASD. Play scripts in the form of visual cues can indicate how to participate in a play opportunity without being too prescriptive. Music opportunities can help reduce self-stimulation and anxiety, thereby helping children naturally engage in spontaneous play with their peers. Design opportunities which address joint attention deficits and promote social skills development in children with ASD include providing opportunities for cooperative types of activities to take place, instead of competitive play. Activities that required low physical effort and low degree of concentration, can contribute to joint attention and social skills development in children with ASD.

## **7 FUTURE RESEARCH**

As discussed earlier, these design strategies represent best practices. There is little, if any, empirical research or case study evidence which supports these best practices. It would be meaningful to provide research through empirically based studies to support evidence based design practices focused on how the design of the outdoor play environment can influence social skills development in children with ASD by targeting specific design strategies and aspects of their play behavior. Given the wealth of research supporting the need for play intervention or instruction to provide or model the structure of play for children with ASD, the

potential for play environments which are physically structured to inherently provide support for the play of children with ASD is significant.

Bowers (1988) suggested that perhaps the design of traditional play equipment, focused on independent play, is counterproductive to the natural play behavior of children, who innately play in small groups. This condition does not facilitate social interaction, which makes it even more difficult for children with ASD to develop cooperative play experiences in traditional playgrounds. The design of traditional playground equipment must be evaluated to allow for activities that involve multiple children playing together, while providing diverse ways for the activities to occur and address the needs of children with ASD.

The design of the outdoor play environment plays an important role in creating spontaneous and pleasurable play opportunities for children with ASD. Well-designed outdoor play environments may support social interactions, creating an important place where children with ASD can develop social skills through play.

## 8 REFERENCES

Adamson, Amanda, Anne O'Hare, and Catriona Graham. 2006. "Impairments in Sensory Modulation in Children with Autistic Spectrum Disorder." *The British Journal of Occupational Therapy* 69 (8): 357–364.

Adrien, J L, E Ornitz, C Barthelemy, D Sauvage, and G Lelord. 1987. "The Presence or Absence of Certain Behaviors Associated with Infantile Autism in Severely Retarded Autistic and Nonautistic Retarded Children and Very Young Normal Children." *Journal of Autism and Developmental Disorders* 17 (3): 407–416.

Arnaiz, Pilar, Francisco Segado, and Laureano Albaladejo. 2011. "Autism and the Built Environment." In *Autism Spectrum Disorders - From Genes to Environment*, edited by Tim Williams. InTech.

Barbour, Ann C. 1999. "The Impact of Playground Design on the Play Behaviors of Children with Differing Levels of Physical Competence." *Early Childhood Research Quarterly* 14 (1): 75–98.

Baron-Cohen, S, A M Leslie, and U Frith. 1985. "Does the Autistic Child Have a 'Theory of Mind'?" *Cognition* 21 (1): 37–46.

B

ass, Jennifer D., and James A. Mulick. 2007. "Social Play Skill Enhancement of Children with Autism Using Peers and Siblings as Therapists." *Psychology in the Schools* 44 (7): 727–735.

Beckwith, J. 1988. "Playground Equipment: A Designer's Perspective." In *Play Spaces for Children: A New Beginning*, edited by Lawrence D. Bruya.

Bowers, L. 1988. "Playground Design: A Scientific Approach." In *Play Spaces for Children: A New Beginning*, edited by Lawrence D. Bruya.

Brock, S. E., Jimerson, S. R., & Hansen, R. L. 2006. *Identifying, assessing and treating autism at school*. New York: Springer.

Bruinsma, Yvonne, Robert L Koegel, and Lynn Kern Koegel. 2004. "Joint Attention and Children with Autism: a Review of the Literature." *Mental Retardation and Developmental Disabilities Research Reviews* 10 (3): 169–175.

Burdette, Hillary L., and Robert C. Whitaker. 2005. "Resurrecting Free Play in Young Children:

Looking Beyond Fitness and Fatness to Attention, Affiliation, and Affect.” *Arch Pediatr Adolesc Med* 159 (1): 46–50.

Dawson, Geraldine, and Renee Watling. 2000. “Interventions to Facilitate Auditory, Visual, and Motor Integration in Autism: A Review of the Evidence.” *Journal of Autism and Developmental Disorders* 30 (5): 415–421. doi:10.1023/A:1005547422749.

Fjortoft, Ingunn. 2001. “The Natural Environment as a Playground for Children: The Impact of Outdoor Play Activities in Pre-Primary School Children.” *Early Childhood Education Journal* 29 (2): 111–17.

Folstein, S E, and B Rosen-Sheidley. 2001. “Genetics of Autism: Complex Aetiology for a Heterogeneous Disorder.” *Nature Reviews. Genetics* 2 (12): 943–955. doi:10.1038/35103559.

Frost, Joe L. 1987. “Child Development and Playgrounds.” In *Play Spaces for Children: A New Beginning*, edited by Lawrence D. Bruya. Garvey, Catherine. 1990. Play. Harvard University Press.

Gillott, Alinda, Fred Furniss, and Ann Walter. 2001. “Anxiety in High-Functioning Children with Autism.” *Autism* 5 (3): 277–286. doi:10.1177/1362361301005003005.

Ginsburg, K. R., and the Committee on Communications, and the Committee on Psychosocial Aspects of Child and Family Health. 2007. “The Importance of Play in Promoting Healthy Child Development and Maintaining Strong Parent-Child Bonds.” *PEDIATRICS* 119 (1): 182–191. doi:10.1542/peds.2006-2697.

Green, D., Charman, T., Pickles, A., Chandler, S., Loucas, T., Simonoff, E., & Baird, G. (2009). Impairment in movement skills of children with autistic spectrum disorders. *Developmental Medicine & Child Neurology*, 51(4), 311-316.

Greenspan, S. L., & Wieder, S. 2006. *Engaging autism: Using the floortime approach to help children relate, communicate, and think*. Cambridge, MA: Da Capo Press.

Greenspan, S. L., & Wieder, S. 2007. The developmental individual difference, relationship-based (DIR/Floortime) model approach to autism spectrum disorders. In E. Hollander, & E. Anagnostou (Eds.), *Clinical manual for the treatment of autism* (pp. 179–209). Washington, DC: American Psychiatric Publishing.

Harrison, James, and Dougal Julian Hare. 2004. “Brief Report: Assessment of Sensory Abnormalities in People with Autistic Spectrum Disorders.” *Journal of Autism and Developmental Disorders* 34 (6): 727–730. doi:10.1007/s10803-004-5293-z.

Hilton, Claudia List, Yi Zhang, Megan R. White, Cheryl L. Kloth, and John Constantino. 2012. “Motor Impairment in Sibling Pairs Concordant and Discordant for Autism Spectrum Disorders.” *Autism* 16 (4): 430–441. doi:10.1177/1362361311423018.

Honey, Emma, Sue Leekam, Michelle Turner, and Helen McConachie. 2007. “Repetitive Behaviour and Play in Typically Developing Children and Children with Autism Spectrum Disorders.” *Journal of Autism and Developmental Disorders* 37 (6): 1107–1115. doi:10.1007/s10803-006-0253-4.

Ingersoll, Brooke, and Laura Schreibman. 2006. "Teaching Reciprocal Imitation Skills to Young Children with Autism Using a Naturalistic Behavioral Approach: Effects on Language, Pretend Play, and Joint Attention." *Journal of Autism and Developmental Disorders* 36 (4): 487–505. doi:10.1007/s10803-006-0089-y.

Jarrold, Christopher, Jill Boucher, and Peter K. Smith. 1996. "Generativity Deficits in Pretend Play in Autism." *British Journal of Developmental Psychology* 14 (3): 275–300. doi:10.1111/j.2044-835X.1996.tb00706.x.

Jordan, Rita. 2003. "Social Play and Autistic Spectrum Disorders A Perspective on Theory, Implications and Educational Approaches." *Autism* 7 (4): 347–360. doi:10.1177/1362361303007004002.

Kasari, Connie, Stephanny Freeman, and Tanya Paparella. 2006. "Joint Attention and Symbolic Play in Young Children with Autism: a Randomized Controlled Intervention Study." *Journal of Child Psychology and Psychiatry* 47 (6): 611–620. doi:10.1111/j.1469-7610.2005.01567.x.

Kern, Janet K., Carolyn R. Garver, Thomas Carmody, Alonzo A. Andrews, Jyutika A. Mehta, and Madhukar H. Trivedi. 2008. "Examining Sensory Modulation in Individuals with Autism as Compared to Community Controls." *Research in Autism Spectrum Disorders* 2 (1): 85–94. doi:10.1016/j.rasd.2007.03.004.

Kern, Janet K., Carolyn R. Garver, Bruce D. Grannemann, Madhukar H. Trivedi, Thomas Carmody, Alonzo A. Andrews, and Jyutika A. Mehta. 2007. "Response to Vestibular Sensory Events in Autism." *Research in Autism Spectrum Disorders* 1 (1): 67–74. doi:10.1016/j.rasd.2006.07.006.

Kern, Petra, and David Aldridge. 2006. "Using Embedded Music Therapy Interventions to Support Outdoor Play of Young Children with Autism in an Inclusive Community-based Child Care Program." *Journal of Music Therapy* 43 (4): 270–294.

Koegel, Robert L., Paula B. Firestone, Kenneth W. Kramme, and Glen Dunlap. 1974. "Increasing Spontaneous Play by Suppressing Self-stimulation in Autistic Children1." *Journal of Applied Behavior Analysis* 7 (4): 521–528. doi:10.1901/jaba.1974.7-521.

Lane, Alison E., Robyn L. Young, Amy E. Z. Baker, and Manya T. Angley. 2010. "Sensory Processing Subtypes in Autism: Association with Adaptive Behavior." *Journal of Autism and Developmental Disorders* 40 (1): 112–122. doi:10.1007/s10803-009-0840-2.

Leary, M. R., & Hill, D. A. (1996). Moving on: autism and movement disturbance. *Mental retardation*, (34), 39-53.

Leekam, Susan R., Carmen Nieto, Sarah J. Libby, Lorna Wing, and Judith Gould. 2007. "Describing the Sensory Abnormalities of Children and Adults with Autism." *Journal of Autism and Developmental Disorders* 37 (5): 894–910. doi:10.1007/s10803-006-0218-7.

Lewis, Vicky, and Jill Boucher. 1995. "Generativity in the Play of Young People with Autism." *Journal of Autism and Developmental Disorders* 25 (2): 105–121. doi:10.1007/BF02178499.



Libby, S., S. Powell, D. Messer, and R. Jordan. 1998. "Spontaneous Play in Children with Autism: A Reappraisal." *Journal of Autism and Developmental Disorders* 28 (6): 487–497.

Lu, L., Petersen, F., Lacroix, L., & Rousseau, C. (2010). Stimulating creative play in children with autism through sand play. *The Arts in Psychotherapy*, 37(1), 56–64.  
<http://doi.org/10.1016/j.aip.2009.09.003>

Mastrangelo, Sonia. 2009. "Play and the Child with Autism Spectrum Disorder: From Possibilities to Practice." *International Journal of Play Therapy* 18 (1): 13–30.  
doi:10.1037/a0013810.

Menear, Kristi Sayers, Shannon C. Smith, and Shane Lanier. 2006. "A Multipurpose Fitness Playground for Individuals with Autism: Ideas for Design and Use." *Journal of Physical Education, Recreation and Dance* 77 (9): 20–25.

Mostafa, M. 2008. "An Architecture for Autism: Concepts of Design Intervention for the Autistic User." *International Journal of Architectural Research* 2 (1): 189–211.

Mundy, Peter, and Mary Crowson. 1997. "Joint Attention and Early Social Communication: Implications for Research on Intervention with Autism." *Journal of Autism and Developmental Disorders* 27 (6): 653–676. doi:10.1023/A:1025802832021.

Myles, Brenda Smith. 2001. *Asperger Syndrome and Sensory Issues: Practical Solutions for Making Sense of the World*. AAPC Publishing.

Naber, Fabienne B. A., Marian J. Bakermans-Kranenburg, Marinus H. IJzendoorn, Sophie H. N. Swinkels, Jan K. Buitelaar, Claudine Dietz, Emma Daalen, and Herman Engeland. 2007. "Play Behavior and Attachment in Toddlers with Autism." *Journal of Autism and Developmental Disorders* 38 (5): 857–866. doi:10.1007/s10803-007-0454-5.

National Research Council. 2001. *Educating children with autism*. Committee on Educational Interventions for Children with Autism, Division of Behavioral and Social Sciences and Education. Washington, DC: National Academy Press.

Nicholson, S. 1971. "The Theory of Loose Parts: How Not to Cheat Children." *Landscape Architecture*.

Ornitz, Edward M. 2009. "The Functional Neuroanatomy Of Infantile Autism". *International Journal of Neuroscience* 19: 85-124.

Pan, C. Y., & Frey, G. C. (2006). Physical activity patterns in youth with autism spectrum disorders. *Journal of autism and developmental disorders*, 36(5), 597-606.

Patten, Elena, and Linda R. Watson. 2011. "Interventions Targeting Attention in Young Children With Autism." *American Journal of Speech-Language Pathology* 20 (1): 60–69.  
doi:10.1044/1058-0360(2010/09-0081).

Rogers, Sally J. 2000. "Interventions That Facilitate Socialization in Children with Autism." *Journal of Autism and Developmental Disorders* 30 (5): 399–409.  
doi:10.1023/A:1005543321840.

Stephens, Carolyn E. 2008. "Spontaneous Imitation by Children with Autism During a Repetitive Musical Play Routine." *Autism* 12 (6): 645–671. doi:10.1177/1362361308097117.

Thomas\*, Nicky, and Caroline Smith. 2004. "Developing Play Skills in Children with Autistic Spectrum Disorders." *Educational Psychology in Practice* 20 (3): 195–206. doi:10.1080/0266736042000251781.

Tsao, L. 2002. "How Much Do We Know About the Importance of Play in Child Development." *Child Educ* 78: 230–233.

VOLKMAR, FRED R., DONALD J. COHEN, and RHEA PAUL. 1986. "An Evaluation of DSM-III Criteria for Infantile Autism." *Journal of the American Academy of Child Psychiatry* 25 (2): 190–197. doi:10.1016/S0002-7138(09)60226-0.

Watson, Linda R., Elena Patten, Grace T. Baranek, Michele Poe, Brian A. Boyd, Ashley Freuler, and Jill Lorenzi. 2011. "Differential Associations Between Sensory Response Patterns and Language, Social, and Communication Measures in Children With Autism or Other Developmental Disabilities." *Journal of Speech, Language, and Hearing Research* 54 (6): 1562. doi:10.1044/1092-4388(2011/10-0029).

Wolfberg, Pamela J., and Adriana L. Schuler. 1993. "Integrated Play Groups: A Model for Promoting the Social and Cognitive Dimensions of Play in Children with Autism." *Journal of Autism and Developmental Disorders* 23 (3): 467–489. doi:10.1007/BF01046051.

———. 1999. "Fostering Peer Interaction, Imaginative Play and Spontaneous Language in Children with Autism." *Child Language Teaching and Therapy* 15 (1): 41–52. doi:10.1177/026565909901500105.

Yang, Tsung-Ren, Pamela J. Wolfberg, Shu-Chin Wu, and Pey-Yun Hwu. 2003. "Supporting Children on the Autism Spectrum in Peer Play at Home and School Piloting the Integrated Play Groups Model in Taiwan." *Autism* 7 (4): 437–453. doi:10.1177/1362361303007004009.

Yuill, Nicola, Sara Strieth, Caroline Roake, Ruth Aspden, and Brenda Todd. 2007. "Brief Report: Designing a Playground for Children with Autistic Spectrum Disorders—Effects on Playful Peer Interactions." *Journal of Autism and Developmental Disorders* 37 (6): 1192–1196. doi:10.1007/s10803-006-0241-8.

## LANDSCAPE URBANISM: AN EXPLORATION IN CONNECTING THE (DIS-CONNECTED) GREEN TO THE (FRAGMENTED) CITY

**LEE, MING-CHUN**

The University of North Carolina at Charlotte, [ming-chun.lee@uncc.edu](mailto:ming-chun.lee@uncc.edu)

### 1 ABSTRACT

*The infrastructural role of landscape as the underlying operating system for future urbanism has been broadly explored by many thinkers and designers over the past century, from Geddes to Gottmann, Mackaye to Mumford, Olmsted to Odum. The traditional notion of landscape as infrastructure stems from the ritual of aesthetic thinking in the 19<sup>th</sup> century, which sees nature as an object, transported by means of green infrastructure into the rapidly growing industrial cities, in order to supply estranged urban dwellers with nature. In light of the current discourse on sustainability and how to cope with climate change and vanishing natural resources, many now believe that a predictable and productive performance is attributed to nature. Its capability to generate renewable energy and healthy food, to clean water, to purify air, etc., is based on the idea of deploying ecosystems as services so that landscape functions as a stable system serving human needs. Green infrastructure is the technology that not only provides ecosystem services, but also ensures their production. This project intended to build on these two established notions of landscape as infrastructure, aesthetic on one side and ecological on the other, and go further to think of landscape as the basic building block of contemporary urbanism, as the “structuring and morphological medium” of human settlements. The premise is that cities are the accumulation and the integration of many individual physical entities, themselves shaped by cultural, social, and economic forces over time. Landscape elements are among such key entities as buildings, streets, blocks, and monuments together act as “place-making” catalysts to shape the form of our cities. Landscape becomes both the lens through which contemporary cities are represented and the medium through which they are constructed.*

#### 1.1 Keywords

Urban design, Sustainability, Urban parks, Green infrastructure

### 2 INTRODUCTION

This paper presents the work of students in the Advanced Urban Design Studio in the School of Architecture at the University of North Carolina at Charlotte (UNC Charlotte) during the spring semester of 2015. In close consultation with University City Partners, planning staff of Charlotte-Mecklenburg County Park and Recreation Department, and landscape architects and urban designers from LandDesign, the studio explored the potential urban design improvements, strategies for integrated open spaces, and impacts of increased mixed-use and commercial

---

The authors are solely responsible for the content of this technical presentation. The technical presentation does not necessarily reflect the official position of the Council of Educators in Landscape Architecture (CELA), and its printing and distribution does not constitute an endorsement of views which may be expressed. Technical presentations are not subject to the formal peer review process by CELA Track Chair System; therefore, they are not to be presented as peer-reviewed publications. Citation of this work should state that it is from a CELA conference paper. EXAMPLE: Author's Last Name, Initials. 2014. Title of Presentation. CELA Paper No. 14-xxxx. Baltimore, Maryland: CELA. For information about securing permission to reprint or reproduce a technical presentation, please contact CELA at [dsolco@uta.edu](mailto:dsolco@uta.edu) or 817-272-2321.

development in Charlotte's University City area, focusing mainly on its Municipal Services District (MSD) and the corridors along major thoroughfares and the future light rail extension is the area. In particular, this sponsored research and design studio used University City as a testing ground for understanding the potential role(s) of urban parks and associated green infrastructure in promoting sustainable urban development and making University City a livable place for residents, businesses, and visitors. Students developed an urban design master plan with a special focus on the incorporation of green open spaces for the area in order to identify future opportunities to expand the area's green infrastructure and help catalyze a new livable and sustainable urban form in the area and beyond.

This studio engaged in both collaborative research and design environments. Working individually and collectively during the research phase of the project, the students conducted site mapping, diagramming, data analysis, and precedent research. With the guidance from our sponsors and collaborators, they mapped out the area's carrying capacity for future urban development and green infrastructures expansion. Key research activities were focused on the following areas: environmentally sensitive areas, existing green amenities and recreational spaces, county-wide framework for green infrastructure, existing land development patterns, current land use regulations, existing transportation networks, demographic structure, socio-economic and physical structure of existing neighborhoods, employment clusters and business centers.

The studio then proceeded iteratively, in stages of exploration, invention, analysis of the impacts of invention, re-invention, master-planning, visioning, as well as urban streetscape and open space design processes. Referring to successful precedents in urban design and parks planning regulation from many major cities around the world, the students modeled and rendered alternative scenarios of building height and massing changes, open space design, street wall and pedestrian environment design, according to different open space typology choices and urban design guidelines and principles that the students themselves devised during these processes. The resulting five proposals, with each of which representing one of the five districts in the area, together formed a cohesive Parks and Urban Design Master Plan for University City.

### **3 LANDSCAPE URBANISM – LANDSCAPE AS INFRASTRUCTURE**

Since we entered the new century, our world has been experiencing a dramatic demographic change in living patterns. For the first time in human history, more people now live in cities than in rural areas (UNPF, 2007). Such a significant shift in where we live demands new emphasis on how we care for and regenerate our urban environments and how we integrate nature into the urban fabric (Gill et al., 2007). Understanding how man-made design interventions influence and are influenced by urban processes and systems is a critical skill to urban designers and planners. And the design of urban places that improve the environment and ecology of cities is the future of the urban design profession.

Much of the reason for revising practices of urban design today derives from the changing nature of cities. The traditional notion of the city as an institutional core surrounded by suburbs and then rural countryside has been largely replaced by a more polycentric and network-like urban sprawl. Given our current environmental predicament and never-ending urban sprawl, the challenge for urban designers is to find ways to revive, redefine the existing urban form that spreads around us (Newman & Jennings, 2008). Perhaps, through the eyes of our mother nature, the forgiving landscape may offer us some clues.

Traditionally, a fuzzy division roughly separates the practices of designing/creating human settlements into two disciplines. On one hand, the field of urban design is focused on fine-tuning a perfect order among various physical elements of cities, such as circulations, movements, street enclosures, spatial sequences and transitions of places, etc. On the other

hand, the practice of landscape architecture pays attentions to the ecological sensibility of various natural systems and their processes with a special focus on the underlying ecological, environmental, and landscape structures that are woven throughout cities. Landscape urbanism combines these two approaches: landscape architecture's understanding of the role of succession, erosion, deposition, and ecology as urban processes, and urban design's understanding of the need for tangible places, defined of street walls, plazas, paths, nodes, edges, landmarks, etc. (Bunster-Ossa, 2001; Corner, 1999a, 1999b, 2006; Shane, 2003; Waldheim, 2002).

Urban landscape systems encompass a wide spectrum of green elements at different geographic scales, with various identities and purposes. At the broad end of this spectrum, region-wide systems connect different landscape patches, open spaces, and other natural features with linear greenways, trails, or corridors to form an ecological network for all living creatures in the region. This type of large landscape system requires regional framework and management policies in order to orchestrate the arrangement and interrelationship of multiple land uses, forms and infrastructures across large areas. At the opposite end of the spectrum, individual green spaces compose form, color, texture, sound, and light via the artistic weaving of earth and water, plants, structure, softscape, and hardscape into multi-dimensional spatial experiences, touching on the spirit of place, and the sensory delights and impacts of sound, touch, taste and aesthetic beauty. These types of small green spaces rely on a bottom-up, community-based, and participatory approach to discovering the unique identity of individual sites thereby making each of them a sacred place for nearby communities (Chiesura, 2004). Urban design sits at the intersection of these scalar positions, regional on one end; local on the other. It helps to determine the nature of open spaces in relation to streets, neighborhoods, buildings, and other structural elements, while aiming to enhance local cultures, traditions, economic development, and provide a sense of place.

#### **4 URBAN GREEN SYSTEMS AND THEIR BENEFITS**

Urban green spaces include a wide range of different components. Apart from parks, these include woodland, street tree and square plantings, cemeteries, private gardens, green roofs, community and allotment gardens, sports complexes, and so forth. These facilities and their associated programs contribute to a city's physical, mental, and environmental health, and support its economic vitality. Establishing and maintaining urban open space systems helps revitalize communities in a variety of ways including increasing economic development opportunities, increasing daily physical activity, reconnecting children with nature, and reducing crime by providing safe, healthy alternatives for at-risk youth (Konijnendijk et al., 2013).

Urban green systems not only stimulate community spirit and boost the local economy, but also promote biodiversity and eco-stability. Their role as the green lungs of the city is of increasing importance as the need to tackle the effects of climate change intensify. There is a need to make our open spaces attractive for everybody and make sure that in any new developments residents has access to a variety of high quality outdoor spaces that are well integrated into the city's urban fabric (Konijnendijk et al., 2013; Young, 1995).

Parks have long been recognized as major contributors to the physical and aesthetic quality of urban neighborhoods. But a new, broader view of parks has recently been emerging. Beyond the traditional value of parks as places of recreation and visual assets to communities, policymakers, practitioners, and the public begin to realize parks as valuable contributors to broader urban policy objectives with the following four tangible benefits: 1) health benefits; 2) economic benefits; 3) environmental benefits; 4) social benefits.

#### **4.1 Health Benefits**

Studies show that when people have access to parks, they exercise more. Regular physical activity has been linked to increasing health and reducing the risk of a wide range of diseases, including heart disease, hypertension, cancers, and diabetes. Physical activity also relieves symptoms of depression and anxiety, improves mood, and enhances psychological well-being. Beyond the benefits of parks offering opportunities to exercise, a growing body of research shows that contact with the natural world afforded by urban parks improves physical and psychological health (Bedimo-Rung, 2005).

#### **4.2 Economic Benefits**

Urban parks do not only provide recreational settings to local residents. Also visitors from out-of-town will use these green spaces. In some cases, especially high-profile parks such as Central Park in New York are even major tourist attractions in their own right. Numerous studies have shown that parks and open space increase the value of neighboring residential property. Growing evidence points to a similar benefit on commercial property value. The availability of park and recreation facilities is an important quality-of-life factor for corporations choosing where to locate facilities and for well-educated individuals choosing a place to work and live. City parks such as San Antonio's Riverwalk Park often become important tourism draws, contributing heavily to local businesses (Sherer, 2006).

#### **4.3 Environmental Benefits**

Green space in urban areas provides substantial environmental benefits. Trees reduce air pollution and water pollution, they help keep cities cooler, and they are a more effective and less expensive way to manage stormwater runoff than building systems of concrete sewers and drainage ditches. Urban parks also offer protection for important critical areas and natural systems (such as wetlands) and for protection for wildlife diversity and habitat. Researchers have stated that urban parks, due to their often high levels of habitat diversity and microhabitat heterogeneity, can constitute particularly important hotspots for biodiversity in the cityscape (Fryd et al., 2011).

#### **4.4 Social Benefits**

City parks also produce important social and community development benefits. They make inner-city neighborhoods more livable; they offer recreational opportunities for at-risk youth, low-income children, and low-income families; and they provide places in low-income neighborhoods where people can feel a sense of community. Access to public parks and recreation facilities has been strongly linked to reductions in crime and in particular to reduced juvenile delinquency. Community gardens increase residents' sense of community ownership and stewardship, provide a focus for neighborhood activities. Large-scale parks may also include facilities, such as zoos, aquariums, cultural and historical sites, and community centers that contribute educational and cultural benefits (Rosenzweig & Blackmar, 1992).

### **5. CONCEPTUAL FRAMEWORK FOR ANALYSIS AND IMPLEMENTATION**

In light of these benefits offered by urban parks, this section discusses a conceptual framework for planning/designing a city-wide open space system. This framework consists of four criteria for site analysis and plan implementation: 1) proximity; 2) connectivity; 3) suitability; 4) livability.

## **5.1 Proximity**

Green open spaces should be in close proximity to other amenities, destinations, local attractions in order to take advantage of these natural assets and add values to their surroundings as a place-making element.

To take advantage of the health benefit of urban green assets, open spaces should be close to natural features, such as creeks, lakes, natural preserves, existing recreational facilities, etc. Urban green spaces bring nature back into the city, provide urban residents with opportunities to enjoy what Mother Nature offers as well as conduct recreational activities for a healthy living.

To take advantage of the economic benefit of urban green assets, open spaces should be within close proximity to local businesses and integrated in retail spaces as outdoor facilities. Small-scale green spaces as amenities to local businesses, offices, retails, enhance place identity and community image, encourage pedestrian foot traffic, and attract tourists.

To take advantage of the environmental benefit of urban green assets, open spaces should be in proximity to natural features. Green open spaces provide the city with so-called “eco-services” and let Mother Nature do the job to clean the water, purify the air, and digest the waste.

To take advantage of the social benefit of urban green assets, open spaces should be close to where people live with easy access by non-motorized transportation modes, such as walking or biking. This allows urban dwellers to use these open spaces as “third place,” leverage social capital, promote social interactions.

## **5.2 Connectivity**

Urban open spaces should be integrated into a larger urban transport system with coordination in pedestrian movements, non-motorized circulations, street connections, public transits, natural corridors, etc.

Linear green spaces, such as greenways, should be connected together to form a green network for the following purposes: 1) ecological purpose: forming a network of connected corridors for wildlife migrations; 2) recreational purpose: establishing a regional attraction network with multiple easy access points to the greenways system.

Parks or recreation facilities should be accessible via a variety of transportation modes. Small-scale parks should be integrated into local neighborhoods within a walkable distance. Regional parks should be accessible via public transits. Micro scale parks, such as pocket parks, can be considered amenities blended into public spaces, such as transit stations, civic places, community centers, schools, churches, etc.

## **5.3 Suitability**

Parks, recreation, and open space come in a variety of sizes, shapes, and types and perform different functions and purposes. No single open space example typifies what open space is. Every community will employ different types of open space within the community. Each community will need to design a system of open spaces that incorporates and interrelates different types of open space to meet a variety of community needs. Each community will therefore need to draw on a variety of tools, resources, and complementary measures to accomplish parks, recreation, and open space objectives.

## **5.4 Livability**

Parks, recreation, and open space design must be integrated into overall community development and planning to effectively provide for these important community features and make all communities a livable place with high quality of life.

The key to livability is “putting people first.” When planning a city-wide open space system, in addition to being natural scenery and aesthetic landscape, parks should be designed in ways they carry multiple functions and become an integral part of the overall urban fabric of the city. Strategies may include: 1) use green open space to create a great environment for pedestrians, bicycles, and other non-motorized vehicles; 2) use green open space to mix people and activities, buildings and spaces; 3) use green open space to preserve and enhance the local, natural, cultural, social and historical assets; 4) use green open space to make walking trips more direct, interesting and productive with small-size, permeable buildings and blocks.

## **6 THE CONTEXT: UNIVERSITY CITY**

University City is in the heart of Northeast Charlotte, surrounding the main campus of UNC Charlotte. It is neighbored by the town of Harrisburg to the east and the city of Concord to the northeast. Attractions along University City’s outskirts include Charlotte Motor Speedway and Concord Mills Mall. University City is home to the PNC Music Pavilion and the 2200-acre University Research Park (URP) located on the west of Interstate 85 (I-85), one of the largest research office parks in the State of North Carolina. IKEA opened a store in University City in 2009 and joined other major retailers, such as Target, Wal-Mart, Home Depot, to have a presence in this area. The URP area houses large companies, such as TIAA-CREF and Wells Fargo, which help contribute to Charlotte’s prowess in the financial industry. Other major businesses or institutions include Carolinas Medical Center (CMC)-University, a large branch library, and a major retail and hospitality center, called University Place, on the east of I-85. University City lies along the I-85 corridor and includes several major Charlotte area thoroughfares including University City Boulevard, W.T. Harris Boulevard, Mallard Creek Church Road, and N. Tryon Street. Much of the existing development patterns are designed to accommodate the automobile. A new presence in University City is the future light rail line and four transit stations – University City Blvd, McCullough, JW Clay Blvd/UNC Charlotte and UNC Charlotte main campus.

### **6.1 MSD**

The study area of this studio project is mainly confined within what North Carolina calls a Municipal Services District (MSD) that includes UNC Charlotte, CMC-University, University Place on the east of I-85, and the University Research Park on the west. Together they comprise University City’s key commercial core. It is bounded generally by Mallard Creek Church Road on the northeast, University City Boulevard on the south, Mallard Creek Road on the west. An MSD allows for the taxation of property owners within the district’s boundaries as a means of generating additional revenue to support enhanced services exclusively for the area.

Several planning efforts have previously been made, including the *University City Area Plan* (UCAP) updated and formally adopted in 2015 covering the MSD east of I-85, the *University Research Park Area Plan* (URP Area Plan) adopted in 2010 covering the western side.

### **6.2 Existing Physical Conditions**

A thorough review and understanding of existing physical conditions – natural/environmental and constructed/man-made – was needed as the first step to help the students identify the opportunities and constraints facing the study area, and to develop the plan vision and concepts that further lead to the development of their open space and urban design proposals. This site analysis process was mainly done through a series of mapping exercise using GIS software (Geographic Information System) to allow the students to “slice” the study site into layers of individual thematic maps, with each one of them containing only certain



aspects of site's current physical details. By doing so, the students were able to "see" the overall composition of various elements that together shape the physical fabric of the University City area.

### **6.3 Opportunities & Constraints**

This thorough investigation of the context of the MSD, mainly its physical conditions and other site factors that may have influences on the study area, helped the students further identify the opportunities and constraints that may affect their vision of the *Open Spaces and Urban Design Master Plan*. The intent was to identify the unique positioning of this area, understand the challenges that exist, and determine how a new vision and its corresponding design strategies can take advantage of future opportunities while addressing existing constraints.

The current street network within the MSD presents a great constraint to the future development of the University City area. I-85 cutting through the area disconnects the URP area from the main UNC Charlotte campus and other established businesses and institutions to the east of I-85. Only a few connections exist between the two sides, which are often congested and prone to traffic accidents. Also those bridges over I-85 were originally designed to carry heavy traffic with very little attention to the comfort and safety of pedestrians and cyclists. The two proposed new multi-modal bridges may hold the opportunity to greatly increase the connectivity between the two sides of I-85 for both motorized and non-motorized traffic. Many major thoroughfares within the MSD, such as N. Tryon St, W.T. Harris Blvd, and University City Blvd, are lacking sidewalks and/or bike lanes. Also very few pedestrian crossings are present along these major roadways in the area.

Most of the residential subdivisions outside the MSD area were developed incrementally over the past two decades. They all generally followed a typical suburban pattern with a curvilinear internal street network forming clusters of isolated enclaves all over the broader University City area. These suburban residential enclaves are in general disconnected to one another with only very limited access points via a few connectors to the major thoroughfares in the area. In addition, these primarily single-family residential subdivisions adjacent to the study site present a challenge for future development, which needs to be sensitive to the distinct characters of these existing neighborhoods.

The still under-construction new LYNX Blue Line extension with its four new stations located in University City presents a great promise for the area to diversify its public transportation choices, reduce the area's dependency on cars, and promote a more compact development pattern with mixed uses and higher density.

The already well-established greenway system in this area along with the vast amount of un-disturbed trees, mostly in the URP area, is a great natural asset to the University City area. Mallard Creek and Toby Creek greenway together already connect the main UNC Charlotte campus to the northern part of the URP campus. With many other new greenways already being proposed or under construction as a portion of Mecklenburg County-wide greenway system and broader Carolina Thread Trail, the University City area will be in a prominent position to become a major node in this ambitious green trail network. In addition, these proposed new greenways will link to the existing ones and form an internal pedestrian network to help break the isolations of the surrounding neighborhoods.

Several existing large regional parks are within close proximity of University City and well serve this area. However, small-scale more family-oriented green outdoor space, such as pocket parks or community playgrounds, is still inexistent in the area. However, the generous green asset present in the area presents a high potential for green space network as an amenity for the area utilizing stream buffers, existing undeveloped land, and preservation of open space in future development.

The Shoppes at University Place functions as the key commercial node within the MSD. Other retail centers scattering across this area with many well-known national/international chain stores, such as IKEA, Wal-mart, Target, Home Depot, together have already transformed the University City area to be a key employment generator and a major commercial/business hub in the Charlotte region. The main campus of UNC Charlotte and CMC-University further add to the significance of the University City area as a key institutional player for the region providing job opportunities, health services, and higher education.

#### **6.4 Overall Green Infrastructure Framework**

One of the issues the students touched upon in their site analysis is the fact that the disconnect between not only the neighborhoods surrounding the MSD but within the MSD itself, and also between greenways in and around the area, some of which are not pedestrian friendly. Introducing green streets therefore became one of the ideas to serve as pedestrian connectors for all these physical elements and provide a greater access for people to walk from one location to another. Possible strategies to implement this idea include: 1) retrofitting existing streets using both the concept of complete street (by adding multi-modal lanes) and low impact development (by adding rain gardens or bio-swales); 2) adding new local collectors following a typical gridiron pattern for a higher degree of connectivity and walkability; 3) better integrating the proposed green streets with existing and future greenways to form a network of pedestrian circulations in the area; 4) better positioning this network of linear green passages in a way various types of open space across the area can all have easy access for people to enjoy.

Within each district in the area, design strategies will be carefully attended to ensure that all green elements, including green streets, parks, and other types of open space, will have their distinct identity. In addition, the types of green open space and their detailed design and amenities will go along with the overall development pattern, types of uses and activities, urban form and architectural appearances, and the streetscape design that the students choose to implement within their respective district.

### **7 STUDIO WORK: THE FIVE DISTRICTS**

To further explore new ways of integrating green infrastructures into the physical fabric of the MSD area, the study site was divided into five districts. Each district has its own distinct physical, environmental, and socio-economic characteristics, and therefore requires different design solutions in terms of open space typologies, development patterns, place-making strategies, and streetscape design qualities. A summary of their characteristics, general design strategies responding to these characters, and the potential open space typologies suitable for each of the five districts respectfully is provided below:

#### **7.1 Innovation Growth Research Park**

- This district encompasses the University Research Park which is home to 200 businesses including 23 Fortune 500 companies and 30,000 employees.
- Its southern section, an area called Governor's Village, besides being the home for four public schools, is in proximity to both single- and multi-family housing near the southwest corner of the site.
- Overall, this district is suitable for additional multi-family residential and further commercial development.
- The URP is connected by W.T. Harris Blvd, Mallard Creek Church Rd, Mallard Creek Rd, I-85, and the Mallard Creek Greenway.

- This area is a prime location for professionals who may be working in one of the 200 businesses in the area. With easy access to the Mallard Creek Greenway, the URP node fosters a Live, Work, Play environment.

Types of open space suitable for the area include:

- Neighborhood parks
- Pocket parks
- Nature preserves integrated with educational institutes
- Greenways for different types of outdoor activities
- Green streets

### **7.1.1 Design Strategies**

Main Purpose: Employment Center and Greenway Nexus

- Major employment center coexisting and thriving with a nexus of the county greenway system
- Connects workforce, residents, and students to amenities within and adjacent to the district through a green network of natural elements and multimodal connections
- Encourages a healthy lifestyle where education, physical and mental health, and nature are essential to positive individual and community well-being through jogging/biking trails, a nature center devoted to the health and history of the creeks, and denoted plazas and pocket parks through the built site and picnic and meditation areas along the creeks
- Ideal for being a center of career and business growth opportunities for a variety of employees and employers who will be encouraged to plant roots in the area, adding to the sustainability of the University City area as a thriving and diverse neighborhood

## **7.2 University Playground**

- This district is within close proximity to UNC Charlotte main campus and CMC-University. The Shoppes at University Place, which is in the heart of this district, serves as a key shopping/commercial hub for the broader University City area.
- Located in the center of MSD with two major arterials W.T. Harris and N. Tryon passing through the edge of this district, as well as the new proposed light rail station connecting the district further to Uptown Charlotte, this area is well accessible by cars and full of potentials to transform to a more compact mixed-use development pattern served by public transit.
- Mallard Creek Greenway provides easy access to the nearby wooded area in the URP area with Doby and Toby Greenway connecting this district further south on both sides of I-85 to the southern portion of URP and UNC Charlotte main campus.

Types of open space suitable for the area include:

- Urban plazas blended with retail stores
- Neighborhood parks
- Circle green (traffic calming)
- Pocket parks serving residential units nearby
- Trails connecting to greenways

### **7.2.1 Design Strategies**

Main Purpose: Recreational center and Hinge Point between natural and artificial factors.

- University Playground builds on the existing shopping center, the University Place, and expands it into a mixed-use recreational center and functions as a hinge point between natural and man-made features.
- Three green belts: Through extending and combining the existing separated green open space systems to connect workforce, residents, and visitors to amenities within and adjacent to the district.
- Two pedestrian axes: Transforming the original retail axis in the University Place to create a vivid linear place for people enjoying farmers' market and festival events. Adding a new secondary axis with rain gardens to provide a peaceful streetscape.
- One lake core: Open up the area fronting the lake and transform it into a gathering playground to serve people of different ages. Visitors enjoy this "lakeshore stage" to be the "audience" and "actors" at the same time.
- A destination for the whole University City area for people enjoy the time with their families, friends and lovers.

### **7.3 McCullough Point**

- This district is already well established with retail and commercial uses. Its close proximity to University Place and CMC-University, as well as its own already established multi-family residential properties together afford this area the opportunity to become a live-work community.
- Its existing natural assets near and across I-85, including un-disturbed tree canopy and Doby Creek to the west of I-85, present great opportunities for creating green infrastructures that connect this area to surrounding districts.
- This district is well served by major thoroughfares along its boundaries, including I-85, N. Tryon, and W.T. Harris. The proposed McCullough light rail station makes this district suitable for mixed-Use transit oriented development with increased residential density and more housing types and transportation choices.

Types of open space suitable for the area include:

- Reclaimed open space for neighborhood parks
- Greenway connection/entrance
- Space for pocket parks within denser areas
- Trail through dense tree coverage behind businesses

#### **7.3.1 Design Strategies**

Main Service: Business District Center and Residential Destination

- Employment hub with residential neighborhoods to support the increase of jobs
- Wide range in green spaces and plazas to create an array of healthy activities for residents and employees
- Limited retail around the edges of the district will support the TOD development adjacent to the McCullough Point Light Rail Station as well as every-day needs of residents
- Green pathways guide people to retail centers such as the gateway district and JW Clay district while smaller green spaces within the district provide small scale recreation and relaxation for a healthy lifestyle

## **7.4 University Area Gateway**

- This district serves as the "gateway" into the University City area, where a station for the Blue Line Extension is currently under development.
- A wonderful place-making opportunity is present due of its proximity to the main intersection of N. Tryon and University City Blvd, all within a quarter mile from the light rail station.
- The parcels within the Gateway node are suitable for commercial and residential mixed-use development, open green space, and multiple greenway connections.
- Within the node are opportunities to improve existing street networks of bike paths, pedestrian walkways, and greenway trails.
- The concept for the Gateway node focuses on providing an aesthetic park to create a sense of arrival as people coming from the station. This open space, adjacent to the N. Tryon and University City intersection, is easily accessible and visible from the station.

Types of open space suitable for the area include:

- Neighborhood parks
- Small pocket parks/ open space adjacent to nearby retail stores and residential units
- Nature preserve parks (small areas within the node that will contain some preserved trees for environmental and health benefits)
- Greenway connections and trails connecting to other surrounding natural assets

### **7.4.1 Design Strategies**

Main Service: Civic and Cultural Center

- Serves as a civic and cultural gateway into University City
- A large aesthetic park for the performing arts provides people with a sense of arrival at the first area LRT stop and the consistently active intersection of Tryon and University City
- Suitable for cultural, commercial, and residential mixed-use development, as well as open space with multiple greenway connections
- Provides an interweaving network of green space consisting of pocket parks, common green areas, civic plazas, linear recreation spaces, and parks integrated with housing to accommodate the need for a safer pedestrian and vehicular environment

## **7.5 University Corridor**

- This district is adjacent to UNC Charlotte main campus and within half mile radius of McCullough light rail station.
- University City Blvd serves as the main arterial connecting the area to Harrisburg to the east and Uptown Charlotte to the southwest (via N. Tryon or I-85). The UNC Charlotte main entrance is located on this road with many newly constructed student apartments nearby with a walkable quarter mile radius.
- The existing Toby-1 greenway meets the proposed Toby-2 greenway near the intersection of W.T. Harris and University City Blvd. Upon the completion of this greenway connection, people will be able to travel on foot both ways further north to Mallard Creek Greenway and south to Little Sugar Creek Greenway.
- Several existing shopping centers are located on the southwest corner of the district along University City Blvd offering amenities such as banks, restaurants, and grocery stores. Through Shopping Center Drive, this commercial portion of the site can be connected to the proposed bridge across I-85, further expanding its reach into the area surrounding McCullough light rail station and the URP area to the west of I-85.

Types of open space suitable for the area include:

- Neighborhood parks
- Pocket parks near housing units
- Green plazas adjacent to campus buildings or retail storefronts
- Greenway connections/extensions

### **7.5.1 Design Strategies**

Main Service: University Living and Learning Neighborhood

- University focused corridor combining Learning, Entertainment, and Living
- Forging a connection between the existing county greenway system by reconnecting Toby Creek Greenways
- Creating a unique identity in the area that celebrates the significance of the University
- Destination for travelers coming into the University area via the Light Rail Extension
- Encourages a lifelong partnership between the University, the existing neighborhoods, and businesses
- Giving ways to forward thinking urban design that will provide a pedestrian focused experience to an area that is greatly lacking in human scale safety

## **8 AFTERWORD**

Following the studio's overall analysis of the University City area, individual project teams focused their efforts to develop five urban design proposals that respectively respond to the unique physical, environmental, socio-economic conditions of the five individual districts within University City. Although individual project teams were granted flexibility to employ different methods for analysis and design, a consensus was clearly made from the beginning of the project for the entire class to follow a set of unified visions they identified as the underlying roadmap to guide the creation of their individual design strategies for the respective districts. These unified visions further provided an instructive range for exploration and speculation of possible design solutions and interventions.

To conclude this first of the three-year cycle of sponsored studios meant to address the needs of University City Partners and Mecklenburg County Park and Recreation Department, this final section summarizes the five underlying visions identified by this project in a hope that the next two classes can continue these efforts with consistency in overall goals and analysis/design frameworks.

### **8.1 Open Space & Environment**

Vision 1: Provide access to natural areas and parks

Green space provides recreation opportunities and connects people with natural systems

- Greenway as catalyst of design
- Promoting healthy living
- Mitigating low density development
- Increasing multi-modal connectivity
- Nature preservation
- Daylighting existing creeks
- Increased surface permeability
- Rooftop gardens

## **8.2 Mobility**

Vision 2: Develop a transportation plan that integrates transit, pedestrian, bicycle and vehicular systems in conjunction with place-making and economic development strategies

A complete transportation system offers multiple choices for people to travel within or beyond the boundaries of the area, either on foot, by bike, public transit, or car.

- Greenway and green fingers as connectors
- Taking advantage of the Blue Line Extension
- Connecting street dead ends
- Pedestrian scale connectivity
- Promote biking
- Increased outdoor activity increases safety

## **8.3 Employment**

Vision 3: Provide good and plentiful jobs close to home

Job sites located within communities reduce time spent on traveling to work

- Increased job base for locals and students
- Local economic development
- Increased retail revenue to support community
- Focus on family owned local businesses – not franchises
- Attracting tourism to promote retail and area assets
- Research and academic opportunities
- Job training to increase opportunity
- Upward mobility in the workspace

## **8.4 Housing**

Vision 4: Provide different housing types for people of all ages and at different income levels

A range of housing types allows residents of differing economic situations to live in the same neighborhood and have access to the same services and resources

- Increased density
- Variety in homes: low-rise, mid-rise, high-rise
- Affordable and single resident occupancy
- Always within walking distance of open space
- Mixed-use buildings
- Adaptive reuse
- Preservation of existing housing stock

## **8.5 Place-making**

Vision 5: Create individual places that have clear identifies and reflect the unique cultural and social conditions of local communities

A clear community identity pertaining to a specific place increases community members' desires to engage in activities designed with the intention to improve the overall quality of their lives in the community.

- Tight knit communities with amenities
- Work-Live-Play
- Pedestrian scale
- Walking and biking safety
- Wide diversity in residents

This collaboration between the Graduate Program in Urban Design at UNC Charlotte, University City Partners, and Mecklenburg County Park and Recreation Department will recommence in spring of 2016 and continue to provide students with an intensive research-based learning experience in areas related to the role of parks, open space and recreational spaces within the University City area as they relate to a larger county-wide framework.

## 9 REFERENCES

- Bedimo-Rung, A., Mowen, A.J. and Cohen, D.A., (2005), 'The significance of parks to physical activity and public health', *American Journal of Preventative Medicine* 28, pp. 159-68.
- Bunster-Ossa, Ignacio (2001). *Landscape Urbanism*. Urban Land. July 2001.
- Chiesura, A., (2004), 'The role of urban parks for the sustainable city', *Landscape and Urban Planning* 68, pp. 129-38.
- Corner, James (1999). Introduction: Recovering Landscape as a Critical Cultural Practice, in Corner, James ed. *Recovering Landscape: Essays in Contemporary Landscape Architecture*. New York: Princeton Architectural Press.
- Corner, James (1999). Eidetic Operations and New Landscapes, in Corner, James ed. *Recovering Landscape: Essays in Contemporary Landscape Architecture*. New York: Princeton Architectural Press.
- Corner, James (2006). Terra Fluxus. in *The Landscape Urbanism Reader*, Waldheim, Charles, ed. New York: Princeton Architectural Press, 2006. p. 21-33.
- Fryd, O., Pauleit, S., Bühler, O., (2011). The role of urban green space and trees in relation to climate change. *CAB Reviews: Perspectives in Agriculture, Veterinary Science, Nutrition and Natural Resources* 6(50).
- Gill, S.E. Handley, J.F., Ennos, A.R., Pauleit, S., (2007). Adapting cities to climate change: The role of green infrastructure. *Built Environment* 33(1), 115-133.
- Konijnendijk, Cecil C.; Annerstedt, Matilda; Nielsen, Anders Busse; Maruthaveeran, Sreetheran (2013). *Benefits of Urban Parks: A systematic review*. A Report for IFPRA, the International Federation of Parks and Recreation Administration, Copenhagen & Alnarp, January 2013. <http://ifpra.org/wup/images/Newsletters/IfpraBenefitsOfUrbanParks.pdf>
- Newman, P. and Jennings, I., (2008), *Cities as Sustainable Ecosystems: Principles and Practices*, Island Press, Washington, D.C.
- Rosenzweig, R. and Blackmar, E., (1992), *The Park and the People*, Cornell University Press, Ithaca.
- Shane, Graham (2003). The Emergence of "Landscape Urbanism". *Harvard Design Magazine*, Fall 2003/Winter 2004, p. 1-8.
- Sherer, P., (2006), 'The Benefits of Parks: Why America Needs More City Parks and Open Space', San Francisco: The Trust for Public Land.
- Society for Ecological Restoration, (2015), South Korea: Restoration of the Cheonggyecheon River in Downtown Seoul, <http://www.globalrestorationnetwork.org/database/case-study/?id=123>
- UNPF (2007). *State of World Population 2007: Unleashing the Potential of Urban Growth*. The United Nations Population Fund, 2007, p.1.
- Waldheim, Charles (2002). *Landscape Urbanism: A Genealogy*." *Praxis Journal of Writing + Building*, Issue 4, 10-17.
- Wikipedia, (2015), High Line (New York City), [https://en.wikipedia.org/wiki/High\\_Line\\_\(New\\_York\\_City\)](https://en.wikipedia.org/wiki/High_Line_(New_York_City))
- Young, T., (1995), Modern urban parks, *Geographical Review* 85, pp. 535-51.



**BIO**

Dr. Ming-Chun Lee is an assistant professor in School of Architecture at the University of North Carolina at Charlotte. He teaches community planning and urban design and conducts research in the areas of digital visualization, GIS, Geodesign, 3-D modeling, and web-based applications. He received his Ph.D. in urban design and planning from the University of Washington in 2008



COUNCIL OF EDUCATORS  
IN LANDSCAPE ARCHITECTURE

*A CELA Conference Presentation*

*Abstract ID: 75*

## **BIORETENTION DESIGN PARAMETERS AS PREDICTORS OF POLLUTANT REMOVAL EFFICIENCY—A DATA DRIVEN APPROACH**

**WANG, RUZI**

Ph.D. student of Urban and Regional Science, Department of Landscape Architecture and Urban Planning, Texas A&M University. [archizz@tamu.edu](mailto:archizz@tamu.edu)

**LI, MING-HAN**

Texas A&M University, College Station, Texas 77843, [minghan@tamu.edu](mailto:minghan@tamu.edu)

### **1 ABSTRACT**

*Bioretention best management practice (BMP) has gained recognition in landscape design because of its potential in reducing flooding and improving stormwater quality. Based on bioretention design manuals, many laboratory and field experiments have been conducted to explore how bioretention designs influence pollutant removal efficiency. However, conclusions of these experiments are not always convergent. Thus, research on bioretention performance is needed to improve our understandings of design parameters and how they affect pollutant removal performance.*

*The purpose of this study is to use published data to create models in predicting bioretention pollutant removal performance with its design parameters. We compiled bioretention design parameters and corresponding pollutant removal efficiencies from 51 publications, in which 54 records were from field experiments and 66 from laboratory experiments. Key design parameters include the ratio of bioretention surface area to the contributing drainage area (SA/DA), filtration media depth, the presence of mulch layer, internal water storage (IWS) layer and organic matter. Water quality data include influent concentration, effluent concentration, and removal efficiency based on concentration and mass. Pollutants of total suspended solid (TSS), heavy metals, and nutrients are included.*

*We found that overall pollutant removal performance of TSS and heavy metals are fairly stable and consistent. However, removal of nutrients varies greatly, which is attributed to leaching of nutrient from soil. Statistic tests indicate that total nitrogen (TN) removal can be predicted with sand/soil media depth, SA/DA, the presence of IWS and organic matter. Organic matter has a negative impact on TN removal performance because of leaching of nitrogen from soil. Other factors are all positively-related factors. Total phosphorous removal can be predicted with sand/soil media depth, SA/DA and the presence of IWS where the presence of IWS has a negative impact and all other factors have a positive impact on pollutant removal efficiency. Heavy metal removals can be improved with thick media layer and the presence of mulch layer. TSS removal is positively associated with the presence of mulch.*

#### **1.1 Keywords**

stormwater, low impact development, water quality, field experiments, internal water storage

---

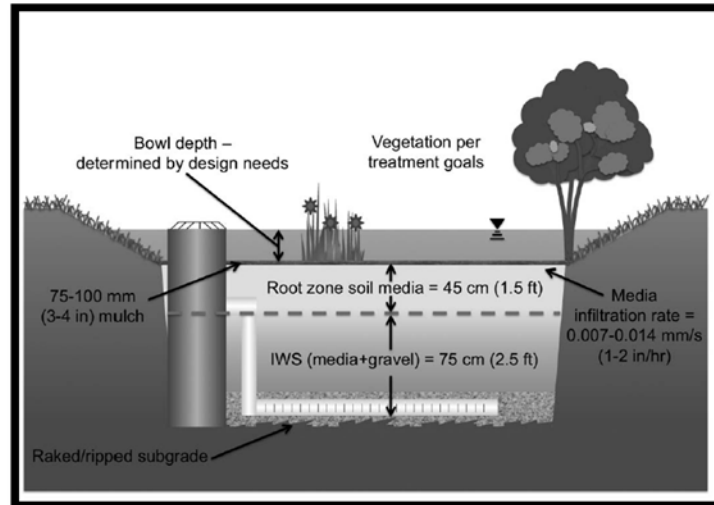
The authors are solely responsible for the content of this technical presentation. The technical presentation does not necessarily reflect the official position of the Council of Educators in Landscape Architecture (CELA), and its printing and distribution does not constitute an endorsement of views which may be expressed. Technical presentations are not subject to the formal peer review process by CELA Track Chair System; therefore, they are not to be presented as peer-reviewed publications. Citation of this work should state that it is from a CELA conference paper. EXAMPLE: Author's Last Name, Initials. 2014. Title of Presentation. CELA Paper No. 14-xxxx. Baltimore, Maryland: CELA. For information about securing permission to reprint or reproduce a technical presentation, please contact CELA at [dsolco@uta.edu](mailto:dsolco@uta.edu) or 817-272-2321.

## 2 INTRODUCTION

Low impact development (LID) techniques, such as bioretention, green roof, permeable pavement and sand filter are aimed to manage stormwater runoff, improve water quality and protect the environment at the source and thus maintain post-development hydrology and water quality condition close to the natural condition (USEPA 2012, McNett et al. 2011, Ahiablame et al. 2012). Bioretention which is a small, terrestrial, soil and plant based infiltration and treatment basin is among the most commonly used LID design tools in the US. It has gained recognition in landscape design because of its potential in reducing flooding and improving stormwater quality in a natural, aesthetically pleasing manner (Khan et al. 2013, Hunt et al. 2012 ). Pollutants carried by urban runoff, if not treated at the source, will result in the degradation of water quality and associated aquatic life in receiving waters (Hsieh and Davis 2005, Liu et al. 2014). The efficiency of pollutant removal exhibited by bioretention has been well documented in literature indicating that bioretention is capable of removing total suspended solid (TSS), heavy metals and nutrients in urban runoff (e.g., Davis et al. 2001, Bratieres et al. 2008, Hatt et al 2009, Li et al. 2014). However, the reduction of pollutants is highly variable in different laboratory and field experiments (Hatt et al 2009).

Bioretention pollutant removal performance appears to be a function of the bioretention facility design (Li and Davis 2009). Understanding of bioretention parameters and how they affect pollutant removal performance help design bioretention to meet specific performance goals. Larger media depth and bioretention surface area may improve pollutant removal efficiency because they lead to longer contact time in the media ( Li and Davis 2009, Luell et al. 2011, LeFevre et al. 2014). Larger media depth also promotes more exfiltration and less outflow volume, thus reducing pollutant concentration by allowing for greater chance of sorption (Brown and Hunt 2011). The composition of bioretention media also plays an important role in enhancing bioretention performance (Ahiablame et al. 2012). Organic matter contents in bioretention media can improve pollutant filtration and adsorption. However, there is tradeoff to export organic matter from bioretention media (Li and Davis 2009). The presence of mulch layer promotes adsorption of heavy metals as well as TSS, thus enhancing the removal efficiency of them (Hunt et al. 2012). Despite the fact that common knowledge of bioretention design has been summarized in the literature, it remains unclear how significant each design parameter influences bioretention performance because conclusions of different field and laboratory experiments are hardly convergent.

Some bioretention design guidelines have been developed in the US by stormwater regulating authorities. Most of them are based on construction experience and synthesis of literature, rather than scientific evidence-based. A science-based bioretention design literature review was published by Hunt et al. stating that it is possible to adjust design parameters such as media depth, media depth, and underdrain configuration to create the “one size fits all” bioretention. A schematic of the “one size fits all” bioretention is presented in Figure 1 (Hunt et al. 2012). A number of physically-based models have been established to predict bioretention pollutant performance with design parameters. These models are always project-based which requires detailed input of all the design variables. The most popular models include L-THIA-LID model, SWMM model, SUSTAIN model and so on (Ahiablame et al. 2012). Recently there have been some data-driven models attempting to characterizing bioretention performance (McNett et al. 2011, Ahiablame et al. 2012). In contrast to physically-based models, data-driven models rely on the statistical connection between design characteristics as input variables and bioretention performance as an output variables. Thus, there is a potential for establishing strong relationships between bioretention design variables and performance.



**Figure 1** The “one size fits all” bioretention (by Hunt et al.)

In this study, we used a data-driven approach to predict bioretention performance with several key design parameters. We compiled published data of field and laboratory experiments to create a database and employ models to predict bioretention pollutant removal performance with its design parameters. The objectives of the study include:

- Identify bioretention design parameters that significantly influence pollutant removal efficiency.
- Apply a data-driven approach to predict pollutant removal efficiency of bioretention BMPs.
- Learn how to design bioretention BMPs that meet different performance goals.

### 3 METHODS

#### 3.1 Creation of Database

We reviewed and extracted bioretention performance experimental data from 51 publications, among which 7 literatures are conference proceedings, and the rest are peer-reviewed journal papers. From the literature, 120 records were collected, including 54 records from field experiments and 66 from laboratory experiments. Publication years are from 2000 to 2015 among which half of the paper are published after 2010. Our search keywords include bioretention, biofiltration and rain garden. Searching database include ISI Web of Knowledge, Wiley, JSTOR, Google Scholar and Open Access Journals and so on.

We then created a database that includes as many design variables as possible, even if some variables are only reported once. The initial design parameters are listed in Table 1. Then several key variables are selected as independent variables in the subsequent predictive model. The first selection criteria is that theoretical bases are demonstrated in the literature in which those key variables play an important role in bioretention performance.

The second criteria is that design parameters are reported in most literature. The final selected key design parameters include:

- experimental type,
- ratio of bioretention surface area to the contributing impervious drainage area (SA/DA),
- filtration media depth,
- sand/soil media depth,

- the presence of mulch layer,
- the presence of internal water storage (IWS) layer
- the presence of organic matter.

**Table 1.** Input bioretention design parameters in the database

Category	Variable	Variable type	Unit	Descriptions and notes
Drainage area	location	text		can be categorized to climate zones in future research
	experimental type*	binomial		laboratory experiment or field experiment
	drainage area	numerical	m <sup>2</sup>	contributing catchment area to bioretention facility. In laboratory experiment, it is an assumed area.
	land use	text		describe land use composition of drainage area
	percent of impervious area	numerical	%	percent of impervious area of drainage area
	impervious area	numerical	m <sup>2</sup>	contributing impervious area to bioretention facility
	SA/DA*	numerical		the ratio of bioretention surface area to the contributing impervious area inside drainage area
Hydrology	site precipitation	numerical	mm/h	rainfall intensity or depth on the site
	inflow type	categorical		natural, synthetic or semi-synthetic

	inflow volume	numerical	m <sup>3</sup>	inflow runoff volume to bioretention cell
	inflow rate	numerical	L/s	inflow runoff rate to bioretention cell
	outflow volume	numerical	m <sup>3</sup>	outflow runoff volume from bioretention cell
Bioretention profile	media depth*	numerical	m	total media depth include mulch layer, sand/soil layer, drainage layer and IWS layer
	sand/soil layer* depth	numerical	m	sand and soil layer depth
	gravel layer depth	numerical	m	gravel drainage layer depth
	mulch layer*	binomial		with or without mulch layer
	mulch layer depth	numerical	m	if mulch layer is present, describe the depth of it
	ponding depth	numerical	m	ponding depth at the top of bioretention
	above ground storage volume	numerical	m <sup>3</sup>	water storage volume above all the media of bioretention
	underdrain	binomial		with or without underdrain
	IWS*	binomial		with or without IWS
	IWS depth	numerical	m	depth of IWS layer
	sub-storage volume	numerical		water storage volume at the bottom of bioretention created by IWS
	percent of sand	numerical		percent of sand in bioretention fill media

Bioretention media	percent of silt	numerical	percent of silt in bioretention fill media
composition	percent of clay	numerical	percent of clay in bioretention fill media
	soil classification	categorical	soil classification include sand, loamy sand, sandy loam, etc. according to soil texture triangle.
	organic matter*	binomial	with or without organic matter
	percent of organic matter	numerical	percent of organic matter in bioretention fill media
	vegetation	text	description of vegetation, can be categorized in the future research

\*selected key design parameters as independent variables in the predictive model

Pollutants recorded include total suspend solid (TSS), copper (Cu), zinc (Zn), lead (Pb), nitrate, nitrite, ammonium, total nitrogen (TN), phosphate and total phosphorus (TP). Due to the small sample size, the final analyzed pollutant categories are limited to TSS, Cu, Zn, Pb, TN and TP. For each pollutant, output water quality data include influent concentration, effluent concentration, and removal efficiency based on concentration and mass. Most of influent and effluent concentration recorded in the literature are based on event mean concentration (EMC) which is a flow-weight index calculated as total pollutant mass divided by total pollutant volume. In the EMC equation (Eq.1),  $C(t)$  refers to the pollutant concentration,  $Q(t)$  refers to the corresponding runoff flow rate and  $t_0$  is the duration of the entire storm event (Davis 2007).

$$EMC = \frac{M}{V} = \frac{\int_0^{t_0} C(t)Q(t)dt}{\int_0^{t_0} Q(t)dt} \quad (1)$$

The key dependent variable representing pollutant removal efficiency is mass removal efficiency calculated below (Eq.2), where  $C_{in}$  and  $C_{out}$  are event mean concentration mentioned above,  $V_{in}$  and  $V_{out}$  are inflow and outflow volume of bioretention facility. Another variable measuring pollutant removal efficiency recorded is percent of concentration reduction (Eq.3). However, performance of bioretention could be underestimated if measured only by concentration reduction, because outflow volume always decreases a lot compared to inflow volume. Thus, in

this study, we focus mostly on pollutant removal efficiency of mass and discuss effluent concentration in the descriptive statistics as well.

$$\text{removal efficiency of mass (\%)} = \left(1 - \frac{V_{out} C_{out}}{V_{in} C_{in}}\right) \times 100 \quad (2)$$

$$\text{removal efficiency of concentration (\%)} = \left(1 - \frac{C_{out}}{C_{in}}\right) \times 100 \quad (3)$$

### 3.2 Statistical Methodology

After variable selection, we tried to build relationships between bioretention design parameters as independent variables and pollutant removal efficiency as dependent variable with some basic statistical tests. Because the data we collected does not satisfy the assumption of normality, linear regression analysis and analysis of variance were not suitable for the study. Alternatively, two nonparametric statistic tests, Kendall rank correlation coefficient and Mann-Whitney U test, were applied to test the relationship between design parameters and bioretention performance. Kendall rank correlation coefficient is a measure of rank correlation shown below. Tau-a statistic tests the strength of associations of two set of variables without any assumptions on the distribution of variables (Eq.4).

$$\tau_A = \frac{n_c - n_d}{n_0} \quad (4)$$

where  $n_c$ =Number of concordant pairs

$n_d$ =Number of discordant pairs

$n_0 = n(n-1)/2$

By calculating Kendall's tau coefficient and running correlation test, we tested the hypothesis that each numerical design parameter has an association with bioretention performance. The range of Kendall's tau coefficient is between -1 to 1. The closer Kendall's tau coefficient is to 0, the more independent two sets of variables are. Positive value of coefficient indicates positive correlation while negative coefficient value indicates negative correlation. Correlation test is also conducted to indicate significance of Kendall's tau coefficient.

For binomial variables including experimental type, the presence of mulch, organic matter and IWS, Mann-Whitney U test was conducted to test the hypothesis summarized from the literature in Table 2. Mann-Whitney U test which is also called Wilcoxon rank-sum test is a non-parametric method to test the null hypothesis that two samples come from the same population. In this study, the significance level of 0.1 is used.



**Table 2** Alternative hypothesis of bioretention pollutant removal efficiency in Mann-Whitney U test (The dependent variables are percent of mass reduction)

	Experimental type	Mulch layer	IWS	Organic Matter
TSS	laboratory	with much >without	with IWS >without	with organic
	experiment > field	mulch	IWS*	matter >without
	experiment			organic matter
Cu	laboratory	with much >without	with IWS >without	with organic
	experiment > field	mulch	IWS*	matter >without
	experiment			organic matter
Pb	laboratory	with much >without	with IWS >without	with organic
	experiment > field	mulch	IWS*	matter >without
	experiment			organic matter
Zn	laboratory	with much>without	with IWS >without	with organic
	experiment > field	mulch	IWS*	matter >without
	experiment			organic matter
TN	laboratory	with much <without	with IWS >without	with organic
	experiment > field	mulch	IWS	matter <without
	experiment			organic matter
TP	laboratory	with much <without	with IWS <without	with organic
	experiment > field	mulch	IWS	matter <without
	experiment			organic matter

\*: Tests are not performed because of the small sample size

## 4 RESULTS

### 4.1 Description of Pollutant Removal Performance

From descriptive statistics of different pollutants, we found that overall pollutant removal of TSS and heavy metals are fairly stable and consistent. Table 3 shows that average percent mass reduction of TSS, Cu, Pb and Zn are 93%, 91%, 90% and 92% respectively. The median values of TSS and heavy metal mass reduction are around 95% which are all larger than the means, which could be explained by the influence of some outliers. Mean values of effluent concentration from bioretention are 10.17 mg/L, 11.63ug/L, 90 ug/L and 18.86 ug/L of TSS, Cu, Pb and Zn respectively. Median values of effluent concentration of Cu, Pb and Zn are 5.95 ug/L, 3.165 ug/L

and 20 ug/L, respectively. With regard to effluent pollutant concentration of heavy metals, median values describe the overall performance more accurately than mean because the scale of outliers are quite different from the regular records. Median values are less sensitive to the outliers than the means.

**Table 3** Descriptive statistics of pollutant removal performance.

	Parameter	Sample size	Mean	Median	Min	Max	Standard deviation
TSS	Effluent concentration (mg/L)	45	10.17	8.93	1.3	39.74	8.33
	Percent of mass reduction (%)	42	92.95	96	71	99.63	7.36
Cu	Effluent concentration (ug/L)	26	11.63	5.95	0	69	0.02
	Percent of mass reduction (%)	21	90.86	94	67	100	9.89
Pb	Effluent concentration (ug/L)	22	18.64	3.165	0.5	230	0.05
	Percent of mass reduction (%)	21	90.1	93	72	99	8.64
Zn	Effluent concentration (ug/L)	25	90	20	0.25	750	0.18
	Percent of mass reduction (%)	22	91.82	96	67	99	9.05
TN	Effluent concentration(mg/L)	71	2.06	1.2	0.11	8.6	1.89
	Percent of mass reduction (%)	61	40.4	47	-164	99	47.82

TP	Effluent	74	0.22	0.1	0.02	3	0.4
	concentration						
	(mg/L)						
	Percent of mass	62	31.95	70.65	-437	99	108.15
	reduction (%)						

Effluent concentrations of heavy metal are compared to EPA water quality standard criteria in Table 4. Surface water quality criteria is presented for the designated use of aquatic life protection and human health. Median effluent concentration of heavy metals all meet the aquatic life (acute) standard of freshwater. 76.9% of copper effluent concentration meet the aquatic life (acute) standard of freshwater. The corresponding percent of zinc and lead are 88% and 81.8, respectively.

**Table 4** Bioretention effluent concentration compared to EPA water quality standard (ug/L)

	Freshwater	Freshwater	Human Health for	Median effluent	Percent of
	(acute) <sup>a</sup>	(chronic) <sup>a</sup>	the consumption	concentration	bioretention records
			of Water +	from bioretention	that meet
			Organism		freshwater (acute)
					standard (%)
Cu	13 <sup>b</sup>	9 <sup>b</sup>	1300	5.95	76.9
Zn	120	120	7,400	20	88
Pb	65	2.5	NA	3.165	81.8

a. criteria is recommended for aquatic life.

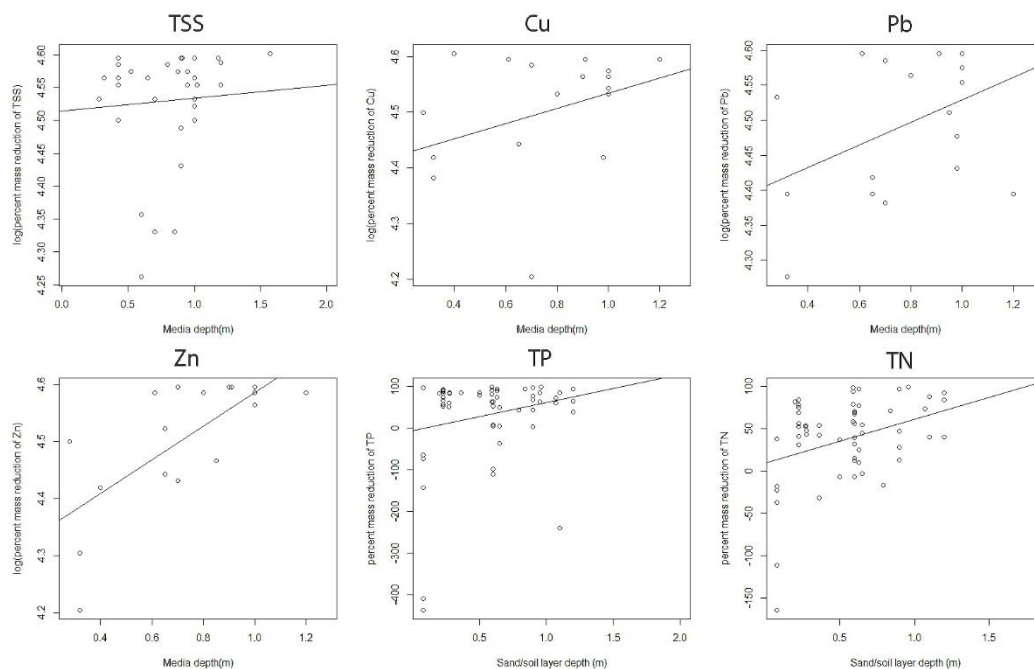
b. EPA does not include the criteria. Criteria from Maryland water quality standard is present instead.

Pollutant removal performance of nutrients varies greatly, which is mostly contributed by leaching of nutrient from soil. Bioretention design requires media to contain organic matter which unfortunately will break down and leach Nitrogen (Clark and Pitt 2009). Thus, for TN removal, average of percent mass reduction is only 40.4%. In the database we created, 10 of 61 samples are negative removal efficiency. With regard to TP removal, the standard deviation is even larger than TN. 10 of 62 samples are negative removal efficiency. Average mass reduction percent of total phosphorous is 32%. Median value is 71% because effect of outliers in TP has a large impact on the dataset. The reason again is leaching of nutrient from filtration media. Phosphorus-laden fill media is always applied which can have an adverse impact on bioretention phosphorous removal performance (Hatt et al. 2009).

## 4.2 Prediction of Pollutant Removal Performance

### 4.2.1 TSS

TSS removal mechanisms are primarily sedimentation and filtration. As Figure 2 shows, the linear relationship between TSS removal and media depth is poor. The scatter plot of TSS removal also indicates the overall high TSS removal efficiency, regardless of media depth. The reason might be that efficient surface filtration can guarantee TSS removal (Hunt et al. 2012, Liu et al. 2014). The outliers in the scatter plot could be caused by fine soil particles washed from the media in early events. However, this phenomenon still has no relationship with media depth (Davis 2007).



**Figure 2\*** Scatter plot of media depth (or sand/soil layer depth) and percent of mass reduction  
\*: For TSS, Cu, Zn and Pb, y axis is log transformation of percent mass reduction

Kendall's tau coefficient indicates that the association between TSS removal and media depth is poor (see Table 5). SA/DA has no effect on TSS removal. It can be concluded that TSS removal happens at the upper layer of fill media so that it is not necessary to increase the depth of the fill media nor enlarge bioretention surface area in order to remove TSS.

**Table 5** Kendall's tau coefficient between percent mass reductions and design parameters\*

	SA/DA	strength of association	Media depth	strength of association	Sand/Soil layer depth	strength of association
TSS	-0.006(0.97)	poor	0.05(0.65)	poor	0.08(0.45)	poor
Cu	0.5(0.005)	good	0.18(0.29)	fair	0.005(0.97)	poor
Pb	0.26(0.15)	fair	0.3(0.07)	fair	-0.3(0.07)	poor
Zn	0.29(0.1)	fair	0.43(0.01)	good	0.004(0.97)	poor
TN	0.17(0.11)	fair	-0.08 (0.4)	poor	0.17(0.08)	fair
TP	0.15(0.19)	fair	-0.1(0.26)	poor	0.18(0.1)	fair

\*: in the () is the p value of Kendall's tau coefficient

In laboratory experiments, TSS removal is significantly better than that in field experiments according to Mann-Whitney U test (see Table 6). Thus, we should be careful in applying the result of laboratory experiment on TSS to field experiment because it is more feasible to control confounding factors in a laboratory setting. Another significant factor influencing TSS removal is the presence of mulch layer. It is because bioretention is able to remove TSS through filtration in the mulch and bioretention media (LeFevre et al. 2014). Thus, it is wise to add mulch layers if the primary pollutant in runoff is TSS.

**Table 6** P value of Mann-Whitney U test and the difference in pollutant removal efficiency

	Experimental Type	Difference	Mulch layer	Difference	IWS	Difference	Organic Matter	Difference
TSS	0.023**	lab>field	0.042**	with mulch>without mulch	NA		0.97	
Cu	0.54		0.14*	with mulch>without mulch	NA		0.92	
Pb	0.02**	lab>field	0.22*	with mulch>without mulch	NA		0.75	

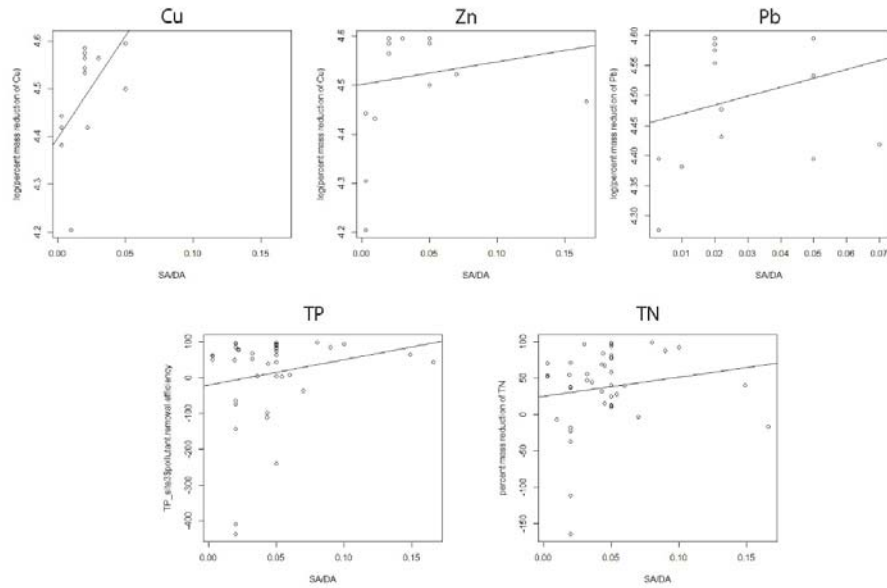
Zn	0.36		0.27*	with mulch>without mulch	NA		0.64
TN	0.39		0.9		0.02**	with IWS>without IWS	0.1** with organic matter< without organic matter
TP	0.006**	lab>field	0.58		0.27*	with IWS<without IWS	0.75

\*: There is some evidence of difference even though p value does not reach significant level.

\*\*: Significant at 0.1 level

#### 4.2.2. Heavy Metals

Media depth demonstrates a moderate influence on heavy metal removal. Figure 3 shows that positive association exists between media depth and heavy metal removal. In addition, some outliers appear when media depth is less than 0.4m. Kendall's tau coefficient also indicates that media depth has fair association with heavy metal removal (see Table 5). Yet for sand/soil layer depth, no association can be found. It makes sense because sand/soil media depth does not include mulch layer, which is a key component for heavy metal removal. Large media depth seems to have a positive effect on heavy metal removal, but the trend is not obvious when the depth is over 0.5m. Both the scatter plot of SA/DA (Figure 3) and Kendall's tau coefficient indicate that larger SA/DA contributes to better heavy metal removal performance. Enlarging surface area of bioretention cell have some effects on heavy metal removal because one of heavy metal removal mechanism is the sedimentation on the surface (LeFevre et al. 2014).



**Figure 3\*** Scatter plot of SA/DA and percent of mass reduction  
 \*: For Cu, Zn and Pb, y axis is log transformation of percent mass reduction

There is some evidence of positive influence of mulch on heavy metal removal according to Mann-Whitney U test (Table 6). Even though p value has not reached 0.1, we tend to accept the alternative hypothesis because mulch layer promotes adsorption of heavy metals thus enhances the removal performance of heavy metals (Hunt et al. 2012). In addition, heavy metals' removal typically correlates with the removal of TSS. Mulch layer which promotes TSS removal will also help remove heavy metal (LeFevre et al. 2014).

Theoretically, Cu has a very strong affinity for organic matter compared with other metals (Blecken et al. 2009, Li and Davis 2009). However, such theory is not supported by the evidence observed in this study. The weak effect of mulch layer and no impact of organic matter are attributed to several reasons. Firstly, the inflow metal concentration typical of urban runoff is sometimes fairly low. Under this condition, even if the effluent concentration is low, pollutant removal efficiency is not high enough to demonstrate a significant effect of mulch layer (Davis 2007). Secondly, literature indicates that Cu is more likely to be dissolved into soil solution than Pb and Zn because of its association with organic matter. Thus, leaching of Cu is also possible from bioretention media (Li and Davis 2009). Overall, mulch layer has some effects in reducing heavy metal concentration, especially for Cu. However, the effect of organic matter on Cu is not supported in this study.

#### 4.2.3 TP

In the Kendall's tau coefficient test, there is a positive association between phosphorous removal and sand/soil media depth (See Table 5). In theory, the principal mechanisms for phosphorous removal are filtration of particulate-bound P and chemical sorption of dissolved P. Removal of phosphorous needs a comparatively longer time to interact with soil media; therefore, deep fill media is required (Hunt et al. 2012). However, no association is found between phosphorous removal and total media depth. It may be because mulch layer which is included in total media depth has little or negative effect on phosphorous removal due to the potential leaching of phosphorous. SA/DA also has a positive association with total phosphorus removal. It might be

contributed by the phosphorus sorption process interacted with the surface sites (LeFevre et al. 2014).

Theoretically, the fraction of organic matter should be limited in the soil content to prevent the breakdown of organic matter and leaching of phosphorous (Hunt et al. 2012). This negative effect of organic matter as well as mulch layer was not observed in the removal of phosphorus (Table 6). The reason might be that only fill media with high phosphorus content has detrimental impacts on bioretention performance. Other organic categories such as carbon content have little impact on phosphorus removal. Literature even suggests that organic carbon could retain phosphorus which has a positive effect on phosphorus removal (Hatt et al. 2009).

Another result is that IWS layer might have a negative effect on phosphorous removal according to the Mann-Whitney U test (Table 6). This conclusion also has theoretical support that anoxic condition in the media could store phosphorous where it is likely to leach out (Hunt et al. 2012). In sum, thick sand/soil filter media, large surface area and the absence of IWS will promote phosphorus removal.

#### **4.2.4 TN**

Unless specifically modified such as adding IWS layer, bioretention cells are aerobic and tend to export nitrate that is converted from ammonium and organic nitrogen (LeFevre et al. 2014). This is the main reason why some bioretention cells have poor nitrogen removal. Despite the challenge of nitrogen removal, adding IWS has a significant positive influence on nitrogen removal efficiency according to the Mann-Whitney U test (Table 6). It demonstrates the significant role of IWS on nitrogen removal and provides evidence for modifying bioretention design manual to add IWS. Meanwhile, adding organic content in the filter media has a significant negative impact on nitrogen removal efficiency. This result indicates that fertilizer which promotes vegetation growth in the beginning of bioretention construction may become unnecessary sources of organic matter leaching nitrogen (Brown and Hunt 2011).

Like phosphorous removal, nitrogen removal also has fair association with sand/soil media depth and SA/DA (Table 5). We notice in the scatter plot of nitrogen removal relationship with sand/soil media depth that the negative outliers are all below the media depth of 0.8m (Figure 2). Larger sand/soil media depth seems to have some effect on removing nitrogen. In addition, there is evidence that enlarging bioretention surface area contributes to better nitrogen removal performance. The scatter plot of SA/DA shows that almost all the outliers lie in the area where SA/DA is below 0.05 (Figure 3). Thus it is necessary to follow the suggested SA/DA ratio between 0.05 to 0.1 according to most bioretention design manuals.

### **4.3 Design Implications**

It is necessary to design bioretention cells based on potential pollutants the cells will treat because different target pollutants require different designs. The “one size fits all” approach of bioretention design is hard to achieve. If we design one bioretention to treat all pollutants, one or more pollutants cannot be treated at a high efficiency. General design guidance is summarized below.

#### **4.3.1 Surface area**

The suggested SA/DA value of 0.05-0.1 in some bioretention design manuals is effective in removing all the pollutants. There is some evidence that enlarging the surface area of bioretention promotes the pollutant efficiency of heavy metal and nutrients. However, SA/DA values larger than 0.1 have little effect on further improving bioretention removal performance. If the target pollutant is heavy metal, SA/DA value of 0.03-0.05 works well in most cases. It seems unnecessary to apply a larger bioretention surface for heavy metal removal.



#### **4.3.2 Media depth and mulch layer**

Media depth has a positive association with all the heavy metals and TSS. For TN and TP, sand/soil layer depth is used instead of media depth because it is necessary to exclude mulch layer. Generally, bioretention depth of about 1m is required. Media depth greater than 1m is not common and may not improve bioretention performance significantly. Most TSS and heavy metals appear to be removed at the top layer. If the target pollutant is TSS or heavy metal, it is not necessary to apply large media depth because general removal efficiency is high already. Mulch layer is needed to further improve TSS and heavy metal removals.

#### **4.3.3 Organic matter**

The result of organic matter is the most obscure. What is significant is only the negative association between organic matter and TN removal. Nevertheless, we should be careful in adding organic matter to bioretention filter media because organic matter can break down and lead to nitrogen and phosphorus leaching. The impact of organic matter on TSS and heavy metal is still not conclusive in this study.

#### **4.3.4 IWS**

IWS significantly helps remove TN because it creates an environment for denitrification. However, adding IWS is a potentially negative factor for phosphorus removal. Literature suggests that if IWS layer stores water too close to the top layer, it may complicate phosphorus removal (Hunt et al. 2012). Thus, we suggest that keeping at least 1m media depth so that IWS layer is not too close to the top layer of bioretention. The impact of IWS on TSS and heavy metal removal is not examined in this research because the limited sample size. Based on the samples at hand, it does not show an adverse effect. Therefore, we suggest adding IWS in bioretention design for removing all pollutants.

## **5 DISCUSSION**

### **5.1 Suggestions on Data Reporting of Bioretention Experiments**

We found that the literature presents bioretention design parameters inconsistently. The description of missing information is listed in Table 7. Missing information of watershed impervious surface ratio is common in laboratory experiments, which accounts for 83.6% of the total records. If this information is missing, it is inappropriate to compare laboratory and field performance data. We suggest to assume the contributing impervious area by controlling inflow volume and rate (Palmer et al. 2013).

More information of media profile and composition is needed as well. Although soil is the key factor for removing pollutants, 30.1% experiments fail to include media profile. 16.3% experiments do not report any information of soil specification, making it impossible to understand bioretention performance mechanisms.

**Table 7** Percentage of missing bioretention design parameters in the literature

	SA/DA	Media profile	Soil composition	Organic matter percentage
Field experiment	28.6%	42.9%	21.4%	47.5%
Laboratory experiment	83.6%	19.4%	11.9%	70%
Total	57.7%	30.1%	16.3%	57.1%

There is a great need for consistency in reporting bioretention design characteristics and performance metrics in a normative format (Strecker et al. 2001). Missing specific performance-related design characters leads to difficulty in the data-driven approach. We suggest that future bioretention experiments report the parameters shown in Table 8 in order to compare with each other. Other parameters should also be reported according to the specific aims of experiments such as ground storage volume, CEC, soil infiltration rate and so on (Brown and Hunt 2011). In addition, it is necessary to report some water quantity parameters such as inflow and outflow volume, inflow rate, and design storms in bioretention experiments. The reason is that in many cases, reduction in outflow pollutant load is the result of modifications in hydrology and water balance (Hunt et al. 2012).

**Table 8** Suggested data reporting format of bioretention design

Design characteristics	Required parameters	Optional parameters	Examples
Watershed information	impervious ratio	watershed area, impervious surface area, landuse	The 110th Cascade system was designed based on a theoretical basin area of 7.3 ha, with land cover in the basin 43% impervious and 57% lawns. (Chapman and Horner 2010).
Footprint	surface area		

Bioretention information	Profile	sand/soil layer depth, mulch layer depth (if applicable), IWS layer depth (if applicable),	gravel layer depth, ponding depth	The depth profile of this biofilter is as follows: 50mm shredded hardwood mulch, 400mm sandy loam, 250mm sand and 200mm gravel (Hatt et al. 2009).
	Media composition	soil classification, percent of organic matter (if applicable)	percent of sand/silt/clay, P (phosphorous) index	The engineered soil media in the cells consisted of 2.9% gravel, 86.8% sand, 7.8% silt, and 2.5% clay with 3-5% of the total soil mix consisting of pine mulch organic matter to enhance microbial activity (Luell et al. 2011).
	Mulch (if applicable)	mulch layer depth	mulch composition	Soil moisture is 14.1% and it is topped with a 12.5-mm layer of mulch (pine bark). This was in order to maintain the soil moisture (Liu et al. 2014).
	Organic matter (if applicable)	percent of organic matter	organic matter composition	The growing media was classified as sandy loam, with a mix of 45%-64% sand, 43%-55% silt, and 5%-18%

			clay with an average organic content of 9% (Khan 2011).
IWS	IWS layer depth	sub-storage volume	The 30-cm ponding depth at the bottom of the BRC was designed to create an internal water storage (IWS) zone, which was included to promote denitrification between storm events (DeBusk and Wynn 2011).

Bioretention performance efficiency metrics are also inconsistently reported in the literature. The dominant metrics are percentage of mass reduction, percentage of concentration reduction and effluent concentration. Some related metrics include pollutant output ratio, event probability distributions, hydraulic efficiency, etc. (Davis 2007, Davis et al. 2011, Khan 2011). With a focus on the three dominant metrics, statistics of literature reporting different metrics are presented in Table 9. Among the 123 bioretention records, most report concentration reduction. Only 26.8% of field experiments report percentage of mass reduction. 51.2% of laboratory literature report percentage of mass reduction. As most literature suggests, water quality improvement should be viewed together with hydrologic improvement because outflow volume reduction is a major contributor to pollutant treatment (Li and Davis 2009, Hunt et al. 2012). However, if only concentration reduction is reported, the degree of bioretention efficiency may be underestimated. When outflow volume decreases, outflow concentration will increase and percent reduction of concentration will decrease. Therefore percent of concentration reduction is not a good estimator of bioretention performance.

**Table 9** Numbers of bioretention records to report mass/concentration reduction

	Report only mass reduction	Report only concentration reduction	Report both
Field experiment	2	23	31
Laboratory experiment	11	37	19
Total	13	60	50

Mass removal percentage sometimes fails to characterize the effectiveness of bioretention because low influent concentration may contribute to insignificant mass reduction. It is the cause

of some outliers in this research, especially for heavy metal removal (Davis 2007). Therefore, it is necessary to report effluent water quality data as a supplement (Strecker et al. 2001). Two reasons to record effluent concentration as indicator of bioretention performance are provided: firstly, bioretention is capable of reducing pollutant concentration down to the “background” concentration. This “background” concentration is determined by the media particles washed out of the bioretention system, sorption capacity of media and processing capacity of biological community (Hatt et al. 2009). Our descriptive statistics of effluent concentration agrees with the “background” concentration theory; Another reason is that high mass removal percentage cannot guarantee surface water quality protection because it might only be contributed by more polluted influent runoff (McNett et al. 2011). In a word, we suggest that reporting mass removal percentage and effluent concentration together to record bioretention performance.

## **5.2 Limitation and Future Research**

We ran each test with approximately 30 samples which is less ideal to create unbiased models. To create unbiased models, we suggest to double the sample size for each test. Due to the limited sample size, we pooled both field and laboratory data in creating predictive models. We plan to expand the database by adding more samples so that we can separate field and laboratory data and create respective models. With a greater sample size, we could also consider other factors for the model such as region and climate.

We did not remove any data points that were compiled from the literature. Some data appear to be outliers but we did not take the step to remove them. This is because of the skewed distribution and the concern of losing some data points in a database that is already small. Again, with a greater sample size, such limitation could be addressed.

The non-parametric models used in this study have some drawbacks. Firstly, the non-parametric models in this research are based on ranking order of the variables. They indicate the general trend of dependent variables with the change of independent variables. However, it cannot predict the performance of a set of new samples with the training data. Secondly, the two non-parametric models cannot include multiple variables, which may reduce the prediction power.

Selection of independent variables affects the model's predicting power. In this study we did not classify organic matter as a categorical variable. We did not record the depth of mulch layer or IWS. This is again due to small sample size. We will include more independent variables in the future research.

## **6 CONCLUSION**

Using published data from the literature, we created a database of bioretention performance and design parameters and used Kendall rank correlation coefficient and Mann-Whitney U test to predict bioretention performance. We found that bioretention effectively removes TSS, heavy metals, nitrogen and phosphorus. Average pollutant removal percentage of TSS and heavy metals are higher than 90%. Median effluent concentration of heavy metals meets EPA water quality standard for protecting aquatic life. Pollutant removal performance of nutrients varies greatly.

Bioretention design parameters can be used as predictors of bioretention performance. Enlarging bioretention surface area improves pollutant removal performance of heavy metal and nutrients. However, SA/DA value larger than 0.1 have little effect on further performance improvement. Media depth has a positive association with heavy metals and TSS removal; Sand/soil media depth has a positive association with nutrients removal. Media depth greater than 1m is not common and may not improve bioretention performance significantly. TSS and heavy metal removals rely mostly on the top mulch layer. IWS has a significantly positive impact on nitrogen removal efficiency while it might have a negative impact on phosphorous removal.

Bioretention cells should be designed with intended goals on specific target pollutants to better meet regulatory needs and local environmental conditions.

## 7 REFERENCE

- Ahiablame, L. M., Engel, B. A., & Chaubey, I. (2012). Effectiveness of low impact development practices: literature review and suggestions for future research. *Water, Air, & Soil Pollution*, 223(7), 4253-4273.
- Blecken, G. T., Zinger, Y., Deletić, A., Fletcher, T. D., & Viklander, M. (2009). Impact of a submerged zone and a carbon source on heavy metal removal in stormwater biofilters. *Ecological Engineering*, 35(5), 769-778.
- Bratieres, K., Fletcher, T. D., Deletic, A., & Zinger, Y. (2008). Nutrient and sediment removal by stormwater biofilters: A large-scale design optimisation study. *Water Research*, 42(14), 3930-3940.
- Brown, R. A., & Hunt III, W. F. (2010). Impacts of media depth on effluent water quality and hydrologic performance of undersized bioretention cells. *Journal of Irrigation and Drainage Engineering*, 137(3), 132-143.
- Chapman, C., & Horner, R. R. (2010). Performance assessment of a street-drainage bioretention system. *Water Environment Research*, 82(2), 109-119.
- Clark, S., & Pitt, R. (2009). Storm-water filter media pollutant retention under aerobic versus anaerobic conditions. *Journal of Environmental Engineering*, 135(5), 367-371.
- Davis, A. P., Shokouhian, M., Sharma, H., & Minami, C. (2001). Laboratory study of biological retention for urban stormwater management. *Water Environment Research*, 73(1), 5-14.
- Davis, A. P. (2007). Field performance of bioretention: Water quality. *Environmental Engineering Science*, 24(8), 1048-1064.
- DeBusk, K. M., & Wynn, T. M. (2011). Storm-water bioretention for runoff quality and quantity mitigation. *Journal of Environmental Engineering*, 137(9), 800-808.
- Khan, U. T., Valeo, C., Chu, A., & He, J. (2013). A Data Driven Approach to Bioretention Cell Performance: Prediction and Design. *Water*, 5(1), 13-28.
- Hatt, B. E., Fletcher, T. D., & Deletic, A. (2009). Hydrologic and pollutant removal performance of stormwater biofiltration systems at the field scale. *Journal of Hydrology*, 365(3), 310-321.
- Hatt, B., Fletcher, T., & Deletic, A. (2009). Pollutant removal performance of field-scale stormwater biofiltration systems. *Water Science & Technology*, 59(8), 1567-1576.
- Hsieh, C. H., & Davis, A. P. (2005). Evaluation and optimization of bioretention media for treatment of urban storm water runoff. *Journal of Environmental Engineering*, 131(11), 1521-1531.
- Hunt, W. F., Davis, A. P., & Traver, R. G. (2012). Meeting hydrologic and water quality goals through targeted bioretention design. *Journal of Environmental Engineering*, 138(6), 698-707.
- Khan, U. T., Valeo, C., Chu, A., & van Duin, B. (2011). Bioretention cell efficacy in cold climates. *Masters Abstracts International* (Vol. 50, No. 01).
- LeFevre, G. H., Paus, K. H., Natarajan, P., Gulliver, J. S., Novak, P. J., & Hozalski, R. M. (2014). Review of dissolved pollutants in urban storm water and their removal and fate in bioretention cells. *Journal of Environmental Engineering*, 141(1), 04014050.
- Li, M.-H., Swapp, M., Kim, M.H., Chu, K.-H., Sung, C.Y., 2014. Comparing bioretention designs with and without an internal water storage layer for highway runoff. *Water Environment Research* 86(5), 387-397.
- Li, H., & Davis, A. P. (2009). Water quality improvement through reductions of pollutant loads using bioretention. *Journal of Environmental Engineering*, 135(8), 567-576.
- Liu, A., Jiang, Y., Dockko, S., & Guan, Y. (2015). Characterizing stormwater treatment efficiency at the laboratory scale for effective rain garden design. *Desalination and Water Treatment*, 54(4-5), 1334-1343.
- Liu, J., Sample, D. J., Bell, C., & Guan, Y. (2014). Review and research needs of bioretention used for the treatment of urban stormwater. *Water*, 6(4), 1069-1099.
- Luell, S. K., Hunt, W. F., & Winston, R. J. (2011). Evaluation of undersized bioretention stormwater control measures for treatment of highway bridge deck runoff. *Water Science & Technology*, 64(4), 974-979.
- McNett, J. K., Hunt, W. F., & Davis, A. P. (2011). Influent pollutant concentrations as predictors of effluent pollutant concentrations for Mid-Atlantic bioretention. *Journal of Environmental Engineering*, 137(9), 790-799.

Palmer, E. T., Poor, C. J., Hinman, C., & Stark, J. D. (2013). Nitrate and phosphate removal through enhanced bioretention media: mesocosm study. *Water Environment Research*, 85(9), 823-832.

Strecker, E. W., Quigley, M. M., Urbonas, B. R., Jones, J. E., & Clary, J. K. (2001). Determining urban storm water BMP effectiveness. *Journal of Water Resources Planning and Management*, 127(3), 144-149.

USEPA (US Environmental Protection Agency). (2012). *Terminology of Low Impact Development*. Washington, D.C: Office of Wetlands, Oceans, and Watersheds. EPA 841-N-12-003B.



COUNCIL OF EDUCATORS  
IN LANDSCAPE ARCHITECTURE

*A CELA Conference Presentation*

**Abstract ID: 76**

## INTERPRETIVE LANDSCAPE DESIGN, RACE, AND PUBLIC HISTORY

### **NELSON, HOLLY**

Rutgers University, 93 Lipman Drive, New Brunswick NJ 08901  
[hgrace@rci.rutgers.edu](mailto:hgrace@rci.rutgers.edu)

### **BAKSHI, ANITA**

Rutgers University, 93 Lipman Drive, New Brunswick NJ 08901  
[Anita.bakshi@rutgers.edu](mailto:Anita.bakshi@rutgers.edu)

### **GOLDSTEIN, DAVID J.**

Urban Fellow, National Park Service, MSU Detroit Center, 3408 Woodward Avenue, Detroit, MI 48201  
[David\\_Goldstein@nps.gov](mailto:David_Goldstein@nps.gov)

### **LAWSON, LAURA**

Rutgers University, 93 Lipman Drive, New Brunswick NJ 08901  
[ljlawson@sebs.rutgers.edu](mailto:ljlawson@sebs.rutgers.edu)

## **1 ABSTRACT**

*Ethnic conflict has flared across the country this past year. How can a design studio integrate design education with focused discussions about ethnicity, difference, and social change? How does this change the design process and product? This paper presents a case study in which students in the St. Croix Praxis studio at Rutgers collaborated with the National Park Service (NPS), St. Croix, USVI, to develop alternative interpretive landscape plans for the Christiansted National Historic Site. The site is associated with the archeological remains and standing architecture of a slave market and its administrative function. The slave market site is the largest, most complete, structural remains of the mercantilism associated with the Trans-Atlantic Slave Trade; the market itself is mostly subsurface, under a central lawn and a main street through town. Few traces of this important history remain, yet the overwhelming majority of the local population can trace its genesis to this site.*

*To more purposefully address issues of ethnicity and identity in design, the studio included fieldwork and interviews in St. Croix, followed by a series of conceptual exercises and visits to mainland NPS sites upon return to New Jersey. These open-ended, exceptionally creative “warm-up” exercises shook students out of their social comfort zones in preparation for site design. As student feedback reveals, the studio process enabled students to explore their own stories relative to culture, history and ethnicity and, as a result, they more flexibly interpreted a public history site.*

### **1.1 Keywords:**

community-based design; ethnicity and design; race and class; cultural place-making

---

The authors are solely responsible for the content of this technical presentation. The technical presentation does not necessarily reflect the official position of the Council of Educators in Landscape Architecture (CELA), and its printing and distribution does not constitute an endorsement of views which may be expressed. Technical presentations are not subject to the formal peer review process by CELA Track Chair System; therefore, they are not to be presented as peer-reviewed publications. Citation of this work should state that it is from a CELA conference paper. EXAMPLE: Author's Last Name, Initials. 2014. Title of Presentation. CELA Paper No. 14-xxxx. Baltimore, Maryland: CELA. For information about securing permission to reprint or reproduce a technical presentation, please contact CELA at [dsolco@uta.edu](mailto:dsolco@uta.edu) or 817-272-2321.



## 2 INTRODUCTION

### 2.1 Ethnicity and Identity in Interpretive Landscape Design

“Narrative allows us to communicate the emotional content of our values. Narrative is not talking “about” values; rather, narrative embodies and communicates those values.”

(Marshall Ganz, “Public Narrative, Collective Action, and Power”, *Accountability through Public Opinion: From Inertia Through Public Action*)

Current events this year have revealed unresolved racial and ethnic issues in America. Given landscape architecture’s vision to “[lead] the design and stewardship of land and communities,” as promoted by the ASLA, what are we doing as a profession and discipline to acknowledge the role of race, class, and ethnicity in people’s relationship to their environments? As noted by Terry Clements, only a small fraction (less than 11%) of CELA pedagogy research concerns social/ cultural issues (Clements 2010). Although many academics have written about community-based design studios working in complex cultural contexts, few write about student experience addressing cultural, race, and class difference (Forsyth 1999; Lawson et al., 2011). Jennifer Britten’s self-reflective practicum provides a starting point to enable students to evaluate their roles as “interpreters and synthesizers of place” through the cultural landscape (Britten 2014); we include overt studio attention to issues of ethnicity and identity in order for students to better interpret the cultural landscape and to tell public history through landscape design. Particularly in the context of a community-based studio, the opportunity to engage design education with cultural learning requires rethinking the prominence of the design product and engaging students with varied exercises that promote reflection and discussion, often outside the traditional bounds of what is design and planning discourse.

This paper presents a case study in which students in the St. Croix Praxis studio, in collaboration with the National Park Service (NPS), St. Croix, USVI, developed conceptual designs for the Christiansted National Historic Site associated with the archeological remains and standing architecture as well as the administrative function of the former slave market located there. The studio, third in a string of collaborations with the NPS on the island, was intended to draw out new ways of thinking about historic interpretation in preparation for a competition to design the site. The 2015 studio was co-taught by Holly Nelson, practitioner, and Dr. Anita Bakshi, who studies urban memory. Juniors, seniors, and second-year graduate students opted to take this studio. The remains of the slave market site currently sit under a central lawn and a main street. Much of this important history is invisible at the site, yet the overwhelming majority of the local population can trace their heritage through this exact location.

To more purposefully address issues of ethnicity and identity in design, the instructors led the class through a series of conceptual exercises with visits to mainland NPS sites and virtual/personal experiences. These open-ended, exceptionally creative “warm-up” exercises shook students out of their social comfort zones in preparation for site design. Outfitted with a real site for a real client (NPS), slavery provided the studio with an overt focus on issues of class and ethnicity. In addition to researching slave trade influences on the Christiansted landscape, we believe this studio created the space for students to explore their own stories relative to culture, history and ethnicity and, as a result, they more flexibly interpreted a public history site. As Marshall Ganz, social science professor at Harvard, says: “In the end you will be asked to link your story of self, story of us, and story of now to a single public narrative.” (Ganz, 2011)

### 3 METHODS

#### 3.1 Background

Prior to visiting the island and meeting the community, the book *August Freedom*, by Liz Carson Rosas, was assigned as required reading to pull students into island history. Selection of this historical novel about an important slave rebellion on St. Croix in 1848 allowed students to follow vivid ‘characters’ and learn the important places in their lives--introducing them to historical figures and locations through a compelling narrative before they set foot upon the island. Development of a personal connection to the island’s history of the formerly enslaved began here.

Students then immersed themselves in St. Croix’s past and present through a weeklong site visit to the island. During this visit, the focus was on understanding a broader history and context for the project; students spent little time at the actual site and instead toured the island’s two major cities, Christiansted and Frederiksted, as well as other historic sites. Their walking tours were led by local guides, often followed by lengthy discussions over meals. One such tour, conducted by local historian “Miss V”, was of the Free Gut neighborhood where freed blacks lived during the 16<sup>th</sup>-19<sup>th</sup> centuries. The guides also encouraged students to talk with people, introducing them to local residents, schoolteachers, students from local schools, and college students from the St. Croix campus of University of the Virgin Islands. As is typical for a studio, the students mapped and sketched in their journals. Having absorbed quite a bit of information during their visit, the students were then asked to present what they learned to residents at a community meeting, thereby allowing students to get additional refined and nuanced feedback. The students conveyed what they heard through cited quotes from people they spoke with and through diagrams and drawings they developed during their tours. The community meeting also provided an opportunity to explain the project that the students would work on for the rest of the semester.

#### 3.2 Conceptual Exercises

##### 3.2.1 The Process

Back in studio, students were assigned weekly conceptual exercises. Each assignment required a synthesis of readings, class discussion, and focused creative exploration. Approximately one third of the semester was spent on these four investigations so that students better understood the cultural history of the site. Hour-long discussions related to readings jumpstarted these creative responses. Each week ended with a pinup accompanied by rich discussion that grew more focused on the lives of the formerly enslaved.

##### 3.2.2 The Exercises

We began with “Walking With The Past”:

###### **Exercise 1: Walking With The Past**

Incorporate the following readings:

**1: (fiction):** *August Freedom*

**2 (history):** *Owning Memory: How a Caribbean Community Lost its Archives and Found its History*

**3: (drawing):** “On and Off the Map”, in *Lure of the Local: Senses of Place in a Multicentered Society*

During our time in St. Croix we visited some of the sites described in the fictional treatment of the island in *August Freedom*, including the fort at Christiansted and several other places. As you walk, sketch what you see, take photographs, and collect artifacts from the site. During the walk with Miss V, take photographs of the sites pointed out by the Storyteller, and take notes about the stories associated with the landscape.

Create a drawing/ map/ collage that incorporates text from written sources, photographs, archival photographs, maps, and oral history excerpts from the walk with a storyteller. The merging of the new and old imagery should convey the experience you had during the walk, and the manner in which your interpretation was affected / influenced by what you read. Think about documenting your journey in time, as well as in space. Think about drawing cinematographically, showing the progression of your movements. Think about how you can layer or weave together the past and the present. Recall the drawing “verbs” that Richard Serra spoke about: *to mix, to knot, to hook, of entropy, to bundle, of grouping, of layering, to join, to bond, to weave, to repair*. These drawings constitute a form of research and applied knowledge. They provide a means to enter into relationship with a place, and to get to know it better.

This exercise combined experiential site discovery with cultural and historical readings relative to change, sensory experiences and a journey through time, using concepts related to: mixing, weaving, repairing, joining and weaving. Projects included a textural collage created from a wall photographed in Christiansted with cutouts highlighting culture and celebrations, overlaid with collaged archival photographs, revealed to the viewer upon closer inspection:

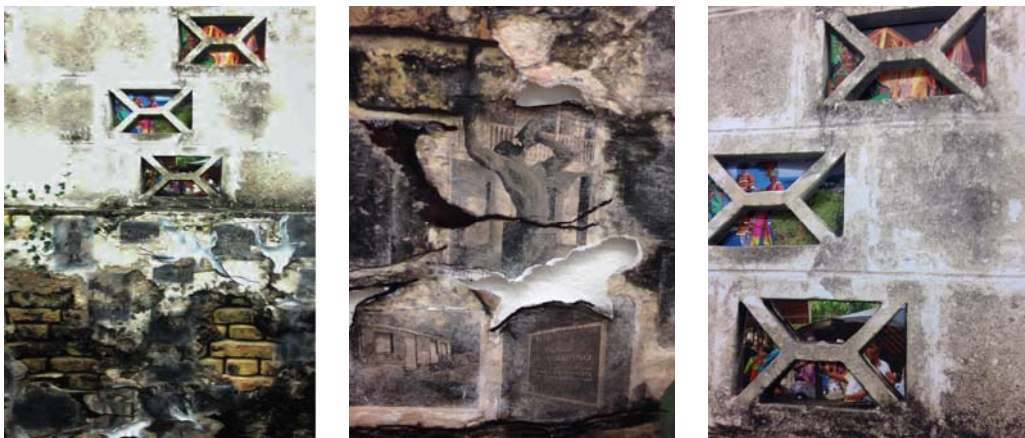


Figure 1a.-c.: C. Beisswanger, *The lasting imprint of African culture and slave history*;  
Detail—Bottom; Detail—Top.

A second project, inspired by a tale in *August Freedom* about how a family wove its history into a basket design, depicts the weaving of stories about the history of slavery on St. Croix. Playing with weaving and the 640'x 640' plantation grid on St. Croix, the student made an interactive version of the 1767 gridded plantation map of the island. When you pull at its warp and weave, he cleverly reveals cultural and historical events and images.

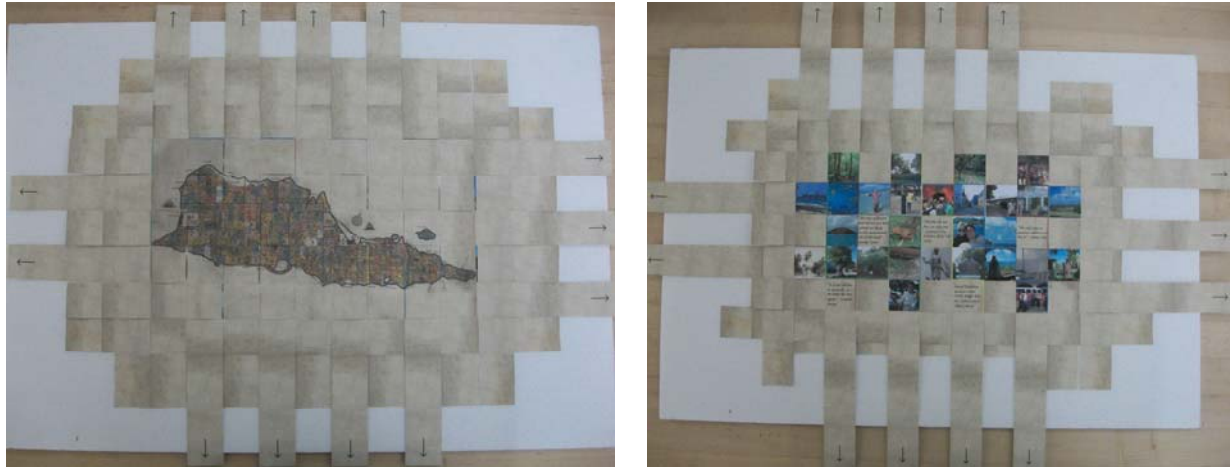


Figure 2: M. Lacey, The weaving of stories into the life of St. Croix

Students revealed history and archeology with the sculpting exercise “Digging and Archeology” to depict the historical context of the site: depict the historical context of the site:

#### **Exercise 2: Digging and Archeology**

We will discuss the following readings :

**1: (history):** *The New Berlin – The Gestapo Terrain: Landscape, Digging, Open Wounds*

**2: (archeology):** *Resistance and Compliance: CRM and the Archaeology of the African Diaspora*

A mahogany tree stump on Hospital Street, adjacent to the Customs House, had to be removed, and since it was the boundary of the original Danish West India and Guinea Company yard that was central to the sale of enslaved Africans from 1749 to 1803 and the Danish sugar trade, NPS archaeologists performed controlled excavations.

Create a designed landscape through excavation and digging. For this exercise you will create a model by carving in a piece rigid model foam. Look closely at the photographs that you took during the dig, and think about the textures that you experienced on the island. How are / how can layers of history be revealed ? Think about how to tie the readings (the importance of the act of digging at the Gestapo terrain site; the critiques of the Cultural Resource Management (CRM) approach to African-American archeology) to St. Croix's slave market. Can you address any of these issues in your model? In addition to working with the foam, you can also incorporate rubbings, artifacts, or photos. Use them to texture to your model, or embed them in the foam and selectively hide and reveal them.

Results ranged from an abstraction of the coral reefs surrounding the island that represented the layering and building up of St. Croix's history to a chipboard model of the Danish Fort upended and forced into the rigid foam that illustrates the impact of the Danish “footprint” on the island's history to a model of the texture of sun/shade under the Tamarind tree where the formerly enslaved gathered to tell stories:



Figure 3: C. Beisswanger, Layered Coral History



Figure 4: A. Scott, Ft. Christiansvaern's Imprint



Figure 5: S. Korapati, Telling history under the Tamarind tree

The next exercise, “Personal Remembrance”, was accompanied by very personal discussions about race and ancestries (Assyrian, Armenian, African American, Peruvian, English, amongst others):

### Exercise 3: Personal Remembrances

Discussion of the following readings:

**1: (memoire):** *False Papers: Essays on Exile and Memory*,

**2: (preservation & tourism):** *Facing the Slave Past: Historic Sites Grapple with America's Greatest Shame*

Design a site for personal remembrances. Create a drawing and collage with personal photographs or images. This could be a space that acts as a memorial to someone important to you, or that commemorates an important personal moment / achievement. Or this might be a space that honors your personal group of affiliation (this could be based on your community of interest, ethnicity, gender, political orientation, race, sexual orientation, etc.).

Has there been a time when someone else has told your story? This is your chance to now represent your story in your own words, as you would like to do. Imagine how you would want visitors and tourists to engage with this site. Create a drawing and collage using personal photographs and show quick perspective vignettes of people interacting with the site.

This exercise marked a turning point as discussion about ethnicity became overt. Sharing personal stories, students opened up to one another. Race was openly discussed relative to the readings and also in terms of current events and lived lives, but the sharing of personal history was deemed of highest importance since not every student was completely comfortable with open discussion of ethnicity. In the project illustrated here, the personal story was without overt relationship to ethnicity, yet it shared a deeply personal story of one very quiet student's struggles with anorexia. You peer through a cutout of her body on the cover of this body image booklet to discover different aspects of her wranglings with the disease. As you turn the pages, she portrays different things that gave shape to her empty body:

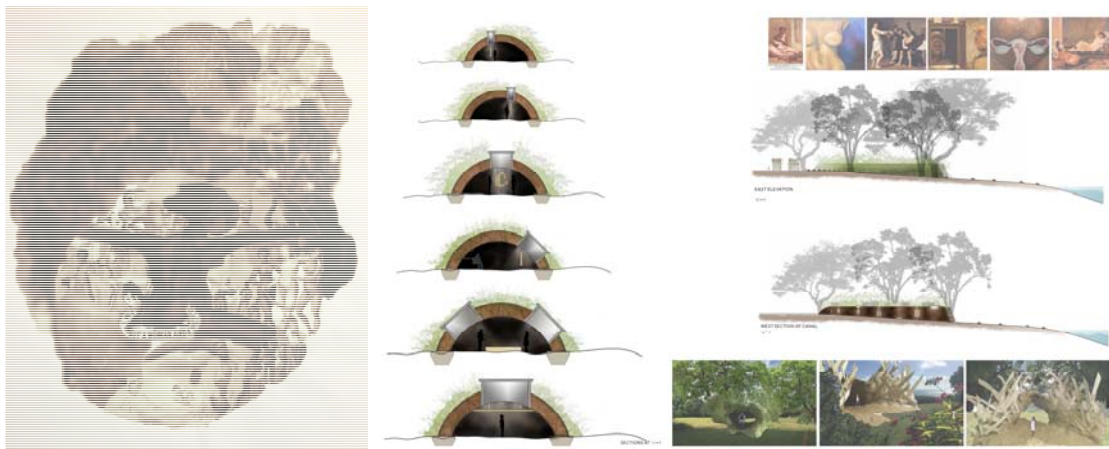






Figures 7a, b, c: S. Korapati, M. Lim, N. Zheng: Creolization on St. Croix

A second project, *Women of St. Croix*, depicts the different power represented by race and gender on St. Croix. Whereas the Danish and African women are depicted quite clearly, Tai'no women in the collage are out of focus since they are so seldom depicted or recognized in the history:



Figures 8 a, b: S. Martinez, *Woman of St. Croix*

This collage led directly to the student's final project, a museum dedicated to enslaved women. Located offsite at a slave village at Cane Garden, a former plantation on the south side of the island, the project connects the slave market to the plantation. Shaped like a birth canal, the rammed earth museum is covered with medicinal plants, including those related to the abortion and infanticide common amongst the enslaved. Gashes in the building (symbolizing rape and abuse) become skylights to daylight the artwork.

## 4 RESULTS AND DISCUSSION

This studio created a unique opportunity to learn more about the slave trade-- to think about its implications and to apply these findings to a design problem. It provided students with a space to talk about race and identity relative to their projects and also on a personal level. Student reflections upon the design project demonstrate the sometimes intense discussions about class and ethnicity that surfaced through the space opened by the conceptual exercises.

"I took this studio with an open mind, understanding that I would learn something about a different culture. I never expected to learn so much about myself, my classmates, the Cruzan people and the lives of all those slaves who have been forgotten....it brought my attention to those who gave their lives to building and making America and other countries what they are today."

(Amber Betances, junior)

In reflecting upon studio outcomes, there is no doubt that the optional nature of this studio was extremely important to its outcome. Students self-selected to study ethnicity issues, and presumably they were more open to cultural history, the cultural landscape, and to this type of discussion. Final reflections revealed that even quieter students who were less comfortable in joining the class discussions had derived benefit from the open discussions. Michelle Lim's Personal Remembrance Body Image Book, described earlier, skirted issues of ethnicity, but her reflection deals directly with ethnicity:

"I grew up in a very diverse part of West Orange, NJ...I had friends of all races and treated them as equals. Although we were taught in school about how unequal certain races were treated in the past, it still came as a surprise to me when I started to realize that racial prejudice still existed. One day, simply taking a stranger's parking spot at the mall by accident meant being told to "go back to my own country" and that I "don't even belong here". And although America is my own country, being born and raised here, it solidified my view on just how hurtful racism could be....we still have much to do and understand about racial prejudice as a whole."

(Michelle Lim, junior)

Over the course of the semester, several students learned from their families about African American relatives whom they had been unaware of before:

"This led to the discovery of my great grandmother being a person of color and my great grandfather being light skinned with blue eyes."

(Josh Rodriguez, junior)

Josh grew up in New Jersey, but despite having lived with his extended family in Puerto Rico for a year as a teenager, he did not recognize his heritage as being other than Hispanic. Similarly, Amber Betances also claimed her Dominican ancestry but not her African roots:

"I had always categorized myself as Latina, a Latin woman and a proud one...the very beginning of my junior year was when it finally hit me. That I, Amber Lynn Betances, was a person of color, that I was a black Latin woman in America....St. Croix Praxis Studio started conversations, conversations about things that not many want to discuss, on color and race and discrimination and where we all come from."

(Amber Betances, junior)

Perhaps the experiences associated with this studio assisted these students in self-identifying as black. On the other hand, other students struggled with the innate, previously unconscious privileges associated with their whiteness.



The focus of the class upon a specific site design problem helped to release intensely personal discussion, yet keep it within confines related to the project. Teaching this studio was invigorating and sometimes terrifying because we plunged into painful subjects. Sometimes we didn't know what to say. To the students' credit, they used their discoveries related to identity to empathize more fully, as is demonstrated by Stacy Martinez whose site design (described earlier) focused on enslaved women:

"This studio not only taught me about the history of the island but of myself as well. I saw through my own personal remembrance the difficulty of expressing my past to individuals who know nothing of me. Revealing secrets that have been enclosed and put away for some time. Knowing my secrets in comparison to those of the island, I understood the delicacy of this project and the importance of history and space."  
(Stacy Martinez, junior)

Students produced a lot of work for this studio, from the conceptual exercises to case studies of other memorials to an interpretive site design. A traditional design studio would assign more time to the site design, particularly because it had a real client. It is a valid criticism of this studio approach that it did not produce fully developed site design proposals. As a studio, we positioned ourselves to ask questions, learn as much as possible, and to test possibilities through design propositions to enable our community partners in their long-term work and ongoing conversations about a proposed slave market proposal. The NPS St. Croix received thirteen conceptual interpretive site design approaches that "started a conversation" about what to consider in an interpretation of not only the slave market site, but also the complicated history of slavery on the island and current economic and social considerations. Some student designs are site-specific while others reach out into the town of Christiansted, and one extends even further by locating a commemoration site on a plantation to connect the memorial more closely with the slaves' daily lives. In some cases, the conceptual exercises outlined in this paper contributed directly to the final projects; other students were captivated by the explorations but failed to directly apply these investigations to their site design. Because our clients and collaborators on St. Croix supported the students' exploration of cultural meaning and memory, we could consider issues of identity in greater depth. Sonia Dow, Executive Director of the St. Croix Landmarks Society, best described this attitude when she stated:

"What I wish for the Rutgers students is the same as what I wish for everyone that we engage with-- that they leave with a better sense of who they are. Even if they don't have roots on St. Croix, the fact that we share who we are as a people hopefully will get them curious about who they are."  
(Sonia Dow, Executive Director, St. Croix Landmarks Society)

## 5 CONCLUSION

Landscape architecture is not a diverse profession. We have been slow to respond to changing demographics in terms of issues of race, gender, and ethnicity, but we can begin to address this in school, an entry point into the profession, hoping that greater sensitivity to different identities and cultural roots will lead to more inclusive design solutions:

"It is important that architects, landscape architects, and planners have designs that are empowered by the history and of the livelihood of the people who live there. There is a lot of power in what a space can translate to, and the Saint Croix studio has taught our classmates how to walk across that bridge as designers. My wish is for the future memorial in Christiansted is for it to be honest and transparent about the actions taken place on the soil in the past, no matter how dark, shameful, and damaged it is."

(Christie Saliba, junior)

Our studio focused equally upon understanding issues of ethnicity and identity as well as upon an actual interpretive site design. In so doing, less time was left for iterative design development; however, educating empathetic practitioners who consider issues of race/ethnicity in design will be increasingly important as the American population becomes increasingly diverse—practitioners who are conscious about ethnicity and whose designs are more inclusive of multiple viewpoints.

## 6 REFERENCES

- Britten, J. (2014). Intersecting Self-Reflection and Skill Development in Landscape Architecture Pedagogy, *CELA Landscape Research Record* 1, 45-54.
- Clements, T. L. (2010). What are we doing today: a snapshot of scholarship in design education and pedagogy. In *Landscape legacy: landscape architecture and planning between art and science*, edited by Gerrit J. Carsjens: ISOMUL, Wageningen University. CD-ROM.
- Forsyth, A., Lu, H. & McGirr, P. (1999). Inside the Service Learning Studio in Urban Design, *Landscape Journal*, 18 (2):166-178.
- Ganz, M. (2011). Public Narrative, Collective Action, and Power. In *Accountability Through Public Opinion: From Inertia Through Public Action*, edited by S. Odugbemi & T. Leep. Washington, D.C.: The International Bank for Reconstruction and Development/ The World Bank.
- Ganz, M. (2013) Worksheet: Public Narrative: self & us & now.  
<http://marshallganz.usmblogs.com/files/2012/08/Public-Narrative-Worksheet-Fall-2013-.pdf>
- Lawson, L., Spanierman, L., Poteat, P.V. & Beer, A. (2011). Educating for Multicultural Learning: Revelations from the East St. Louis Design Studio" in *Service Learning in Design and Planning: Educating at The Boundaries*, edited by T. Angotti, C. Doble, & P. Horrigan. Oakland, CA: New Village Press.
- Lawson, L. (2007). Parks as Mirrors of Community, *Landscape Journal* 26 (1), 116-133.

## 7 ASSIGNED READINGS

- Aciman, A. (2001). Shadow Cities. Chapter in *False Papers: Essays on Exile and Memory*. New York: Farrar Strauss Giroux, 37-48.
- Bastian, Jeannette (2003). *Owning Memory: How a Caribbean Community Lost its Archives and Found its History*. Westport, CT: Libraries Unlimited, 1-18.
- Cronon, W. (1995). The Trouble With Wilderness. In *Uncommon Ground: Rethinking the Human Place in Nature*, edited by William Cronon. New York: W.W. Norton & Co., 69-90.
- Davis, M.A. (2011) Don't Judge Species on Their Origins, *Nature* 474 (7350). 153-4.
- Espenshade, C., & Norton, H.K. (2007). The Challenge In Locating Maroon Refuge Sites At Maroon Ridge, St. Croix, *Journal of Caribbean Archaeology* 7.
- Goodheart, A. (2001). Facing the Slave Past: Historic Sites Grapple with America's Greatest Shame, *Preservation* 53 (September/October), 36-43.
- Hood, W. J. & Erikson, M. (2001). Storing Memories in the Yard. In *Sites of Memory: Perspectives on Architecture and Race*, edited by Craig Barton. Princeton: Princeton Architectural Press, 171-189.
- Joseph, J. W. (2014). Resistance and Compliance: CRM and the Archeology of the Diaspora, *Historical Archeology* 38 (1), 18-34.
- LaRoche C.T. & Blakey M.L. (2014). Seizing Intellectual Power: The Dialogue at the New York African Burial Ground, *Historical Archaeology*, 31(3).

- Lippard, L.R. (1997). *The Lure of the Local: Senses of Place in a Multicentered Society*, New York: The New Press.
- Mack, M.E. & Blakey, M.L. (2014). The New York African Burial Ground Project: Past Biases, Current Dilemmas, and Future Research Opportunities, *Historical Archaeology*, 38 (1).
- Mann, C.C. (2011). Crazy Soup, & Forest of Fugitives. Chapters in *1493: Uncovering the World Columbus Created*, New York: Vintage Books, 281-345.
- Purnell, B., (2010). Exhibition Review: African Burial Ground National Monument, *The Journal of American History*, December.
- Rosas, L.C. (2009). *August Freedom*. CreateSpace Independent Publishing Platform.
- Till, K.E. (2005). The Gestapo Terrain: Landscape, Digging, Open Wounds. Chapter in *The New Berlin: Memory, Politics, Place*, Minneapolis: The University of Minnesota Press, 63-106.

# **THE SOCIAL PREFERENCE FOR LANDSCAPE PERFORMANCE: A CASE STUDY OF FOUR CHINESE URBAN PARKS**

**YANG, YANG**

South China University of Technology, China, [yangyyla@outlook.com](mailto:yangyyla@outlook.com)

**LIN, GUANGSI**

South China University of Technology, China, [asilin@126.com](mailto:asilin@126.com)

**ZHAO, HONGHONG**

South China University of Technology, China, [arhhzhao@scut.edu.cn](mailto:arhhzhao@scut.edu.cn)

## **1 ABSTRACT**

*The sustainable development aims at the balance of environmental protection, economic development and social equity. However, theoretically, there are conflicts among these three aspects, and in practice, the three aspects are usually unbalance, appearing a certain preference. Seeking to mitigate such conflict relations and promoting coordinated development of three aspects in sustainable landscape, this paper is to explore the benefits composition of built projects and the potential common rules behind the preference, based on the performance results of cases in the Case Study Investigation Program (CSI) by the Landscape Architecture Foundation (LAF).*

*Following literature review, a comparative study is carried out of the landscape performance of four model urban parks in China as empirical subjects, and four parks in the U.S. as empirical baseline. The study comes to a conclusion that there are different performance preferences in the case projects within different social contexts, and within China's social context the projects' performance preference is characterized by prominent environmental benefits and poor social and economic benefits.*

*In order to discuss the potential social universality and impact factors of performance preference in case projects, this paper draws up the hierarchical influence factor diagram of landscape performance. Accordingly, the paper discusses the potential common characteristics of the four subjects' preference, so as to define the universality of the social preference. Finally, it explores the impact factors of the social preference at the national level.*

### **1.1 Keywords**

landscape performance, social preference, sustainable landscape, urban park, Case Study Investigation

## **2 INTRODUCTION**

Sustainable planning, design and construction have been the key research topics in the field of Landscape Architecture. With the current research trend of evidence-based design, it is inadequate to argue what benefits the sustainable landscape could bring, but how and how much? So the quantitative studies are increasingly emphasized to make clear the actual benefits of built

---

The authors are solely responsible for the content of this technical presentation. The technical presentation does not necessarily reflect the official position of the Council of Educators in Landscape Architecture (CELA), and its printing and distribution does not constitute an endorsement of views which may be expressed. Technical presentations are not subject to the formal peer review process by CELA Track Chair System; therefore, they are not to be presented as peer-reviewed publications. Citation of this work should state that it is from a CELA conference paper. EXAMPLE: Author's Last Name, Initials. 2014. Title of Presentation. CELA Paper No. 14-xxxx. Baltimore, Maryland: CELA. For information about securing permission to reprint or reproduce a technical presentation, please contact CELA at [dsolco@uta.edu](mailto:dsolco@uta.edu) or 817-272-2321.

sustainable landscapes, and show the significant value of built environment. In related research, aiming at demonstrating the environmental, social, and economic value of sustainable landscapes, the Landscape Architecture Foundation (LAF) launched the Landscape Performance Series (LPS; LAF, 2013a; ASLA, 2015a) in 2010, inspired by the forerunner of building performance. Before that, the Case Study Investigation (CSI; ASLA, 2015b) was well established by LAF to measure the environmental, social, and economic benefits of exemplary Landscape projects and document it as a case study, of which the performance data and results are published in the Case Study Briefs (CSB; LAF, 2013b) on the website of LPS. To date, over 100 case studies have been completed.

Sustainable development is described as the balance of the three goals: environmental protection, economic development, and social equity (Scott, 1996). Basing on the three aspects of sustainability: environment, economy and society, LFA establishes the theoretical framework of landscape performance, and the comprehensive benefits of the three could be the evaluation criteria of sustainable landscape. Meanwhile, theoretically, the three aspects of sustainability have interest clashes, among which there are unavoidable conflicts (Scott, 1996). These conflicts are documented in many studies. Zhao Jingzhu et al (1999) indicate the three social, economic, natural systems are so diverse that the existence and development of them are mutual checks; Jiang Xin (2005) argues there is a unbalance relationship between economy and ecology by nature, and the modern economy is swallowing various natural resources, yet taking the eco-environment as site of waste discharging; As Song Guohui and Li Yunfeng (2012) claim, during the course of West China Development Campaign, although there are dramatic improvement in economy, culture and social life in the western region, the ecological environment is quite fragile. Therefore, due to the conflict among the correlation, the three aspects of sustainability is usually unbalanced, appearing a certain preference.

To further explore the benefits composition and relationship in sustainable landscape, it is needed to analysis the performance evaluation results of built landscape projects. Luo Yi and Li Ming-Han (2014) have a discussion basing on the results from CSI case studies, and claim these three benefits interact and sometimes conflict with each other. Such conflict may cause unbalance in sustainability composition, which is referred to preference. That is to say, in landscape practices, the social dominant including designer, decision making, investor, and user would prefer variously to a certain benefit to others according to their interests or conditions. In that case, understanding whether there is a certain rule in the benefit preference, and potential impact factor allow designer to change their preferences, then mitigate the conflicting relationship and create comprehensively balanced benefits for sustainable landscape.

In order to verify the social preference of landscape performance, this study uses some similar landscape cases in the same social context; besides the cases in the U.S. could be the baseline of sustainable landscape, because of its steady state in socio-economic development worldwide. As China is in a period of rapidly urbanization, with the prominent contradiction between environment, economy and society, the theory and practice of sustainable landscape has been long-term concerned by the government and community. Thus, in this study, we used the four landscape performance cases studies, published in CSB based on CSI, from China as objectives. These four cases were model urban parks built over the last decade, which are Beijing Olympic Forest Park (2012), Tianjin Qiaoyuan Park (2012), Tangshan Nanhu Eco-city Central Park (2011), and Shanghai Houtan Park (2011). Following literature review and comparative study, this specific research is divided into two aspects: 1) within different social context, select four American cases similar to these four Chinese cases in scale and type from CSB, comparing their performance characteristics; 2) within the same social context, take an analogical study on the performance characteristics between the four Chinese cases. Thereafter, this study comes to a conclusion about the social preferences for landscape performance of the cases. And then, it discusses the influential factors towards landscape performance preference.

### 3 MATERIALS & METHODS

#### 3.1 Empirical subjects

As representatives of landscape built in the last decade in China, the four main park cases are well known in the world and selected by LPF as case studies on landscape performance evaluation, reflecting the status of sustainable landscape construction and development in China. These cases are all urban comprehensive park style of projects, the former sites mainly used to be brownfield, greyfield, and residential. In these cases, Beijing Olympic Forest Park and Tangshan Nanhu Eco-city Central Park are large-scale parks, and Tianjin Qiaoyuan Park and Shanghai Houtan Park are medium-scale parks; in terms of site feature, they are all parks with multi-function including wetland, environmental restoration, stormwater management and so on, of which Olympic Forest Park and Nanhu Eco-city Central Park have the function of urban natural protection.

#### 3.2 Research approach

Based on literature review, a qualitative and quantitative multi-method was chosen to make comparative analysis in two aspects: 1) with the standard of similar construction time and scale, select four park cases from the U.S. (published in LPS) as comparative group with Chinese cases to conduct analysis on social preference of landscape performance in different social context; 2) within the same social and construction context, conduct a comparative analysis on the benefit composition between the four cases in China.

The research approach included two main phases: first, data collection through the selection of case studies briefs on LPS website, related case design documents and literatures; and second, data analysis through a comparative analysis of landscape performance.

#### 3.3 Data collection

Performance evaluation conclusions of eight cases in the U.S. and China respectively (published in LPS), and basic data of relevant cases were selected for organizing and summarizing. The eight cases are all urban parks built in recent decade, over 1000 acre or under 50 acre in size, and mainly used to be brownfield and greyfield. Table 1 and Table 2 show the construction background of the selected cases from the two countries. Table 3 show the summarized performance information of these cases according to three categories of environmental, social, and economic benefits.

**Table 1.** Basic Information of Cases in China

(Source: LPS. <http://landscapeperformance.org/case-study-briefs>.)

Case Project	Location	Size (acre)	Former Land Use	Project Function	Completion Time	Budget (million US \$)
Beijing Olympic Forest Park	Beijing	1 680	Residential	Nature preserve; Open space; Wetland	2008	420
Tangshan Nanhu Eco-city Central Park	Tangshan, He Bei	1 557	Brownfield	Nature preserve; Open space; Wetland	2009	68

Tianjin Qiaoyuan Park	Tianjin	54	Greyfield	Open space Wetland	2008	14.1
Shanghai Houtan Park	Shanghai	34.5	Brownfield	Open space; Waterfront redevelopment Wetland	2010	15.7

**Table 2.** Basic Information of Cases in the U.S.

(Source: LPS. <http://landscapeperformance.org/case-study-briefs>.)

Case Project	Location	Size (acre)	Former Land Use	Project Function	Completion Time	Budget (million US \$)
Napa River Flood Protection Project	California	1011	Brownfield	Open space	Expected: 2015	550
Palmisano Park	Chicago, Illinois	27	Brownfield	Nature preserve Open space	2010	10
Buffalo Bayou Promenade	Houston, Texas	23	Greyfield	Open space Stream restoration	2006	15
Renaissance Park	Chattanooga, Tennessee	22	Brownfield	Open space Waterfront redevelopment	2006	8

**Table 3 a.** Main benefits of projects in China (Source: LPS. <http://landscapeperformance.org/case-study-briefs>.)

Project	Main Benefits	Environmental Benefits	Social Benefits	Economic Benefits
Beijing Olympic Forest Park	Carbon sink	●		○
	Water saving	●		○
	Energy saving	●		○
	New energy resources	●		○
	Sewage disposal	●		
	Providing animal habitat	●		
	Biodiversity protection	●		
	Stormwater management	●		
	Providing recreation		●	
	Outdoor teaching		●	
	Job creation		●	●
Tangshan Nanhu	Carbon sink	●		○
	Climate regulation	●		

Eco-city Central Park	Providing animal habitat	●		
	Biodiversity protection	●		
	Water saving	●		○
	Waste gas treatment	●		
	Waste recycling	●		○
	Providing recreation		●	
	Commercial taxation			●
	Enhancing land value			●
Tianjin Qiaoyuan Park	Carbon sink	●		○
	Soil improvement	●		
	Providing animal habitat	●		
	Native biodiversity protection	●		
	Stormwater management	●		
	Pollution treatment	●		
	Waste recycling	●		○
	Reducing noise		●	
	Providing recreation		●	
	Outdoor teaching		●	
	Environmental education		●	
Shanghai Houtan Park	Carbon sink	●		○
	Sewage disposal	●		
	Providing animal habitat	●		
	Native biodiversity protection	●		
	Water and soil conservation	●		
	Water saving	●		○
	Waste recycling	●		○
	Providing recreation		●	
	Scientific education		●	
	History and cultural memory		●	
	Low maintenance cost			●

**Table 3 b.** Main benefits of projects in the U.S. (Source: LPS. <http://landscapeperformance.org/case-study-briefs>.)

Project	Main Landscape Benefits	Environmental Benefits	Social Benefits	Economic Benefits
Napa River Flood Protection Project	Stormwater management	●		
	Ecological restoration	●		
	Providing animal habitat	●		
	Scientific education		●	
	Providing recreation		●	
	Pedestrian system		●	



	The public participation and protection policy		●	
	Job creation		●	●
	Retail			●
Palmisano Park	Stormwater management	●		
	Water saving	●		○
	Waste recycling	●		○
	Providing animal habitat	●		
	Providing recreation		●	
	Holding activities		●	
	Neighborhood improvement		●	
	Aesthetics of landscape		●	
	History and cultural memory		●	
	Driving house prices			●
	Low maintenance cost			●
Buffalo Bayou Promenade	Stormwater management	●		
	Carbon sink	●		
	Providing recreation		●	
	Scientific education		●	
	Holding activities		●	
	Promoting healthy lifestyle		●	
	Outdoor sports		●	
	Security creation		●	
	Job creation			●
	Retail			●
Renaissance Park	Pollution treatment	●		
	Water saving	●		○
	Providing animal habitat	●		
	Stormwater management	●		
	Providing recreation		●	
	Scientific education		●	
	Promoting healthy lifestyle		●	
	Promoting consumption		●	
	Housing choice		●	
	Community investment			●
	Increasing land value			●
	Cost saving			●
	Low maintenance cost			●

Note: “●” represents direct benefit, each “●” is counted once in calculation of benefits below;

“○” represents attached benefit, created by some environmental or economic benefits, whole “○” are accounted once in each project in calculation of benefits below.

### 3.4 Data analysis

First, with a variable of the social context, and the construction time, scale, and type in line, this study focused on the ratio of each number of three benefit categories in a project to comparatively analyze the various landscape performance composition between two groups of cases from China and the U.S. Accordingly, the ratio of the three environmental, social, economic

benefits is calculated in the following Equation I (refer to the logic of Equation II). The specific data of benefits are showed in Table 3, in which each of the benefits is valued at 1.

Equation I :

$$R_b=B_1:B_2:B_3 ;$$

Where  $R_b$  represents the ratio of each number of the three types of benefits;  $B_1$  represents the total number of the environmental benefit;  $R_b$  represents the total number of the social benefits;  $B_3$  represents the total number of the economic benefits.

Second, to further understand the composing characteristics of landscape performance in the specific social context of China, the ratio of the number of each type of benefit to the total benefits number in a project is calculated in the following Equation II (Luo, Li, 2014).

Equation II :

$$R(R_1,R_2,R_3)=\frac{\text{number of each type of benefits}}{\text{total number of benefits}} \times 100\%$$

Where  $R_1$ ,  $R_2$  and  $R_3$  represent the ratio of the number of the environmental, social, economic benefit respectively to the total benefits number.

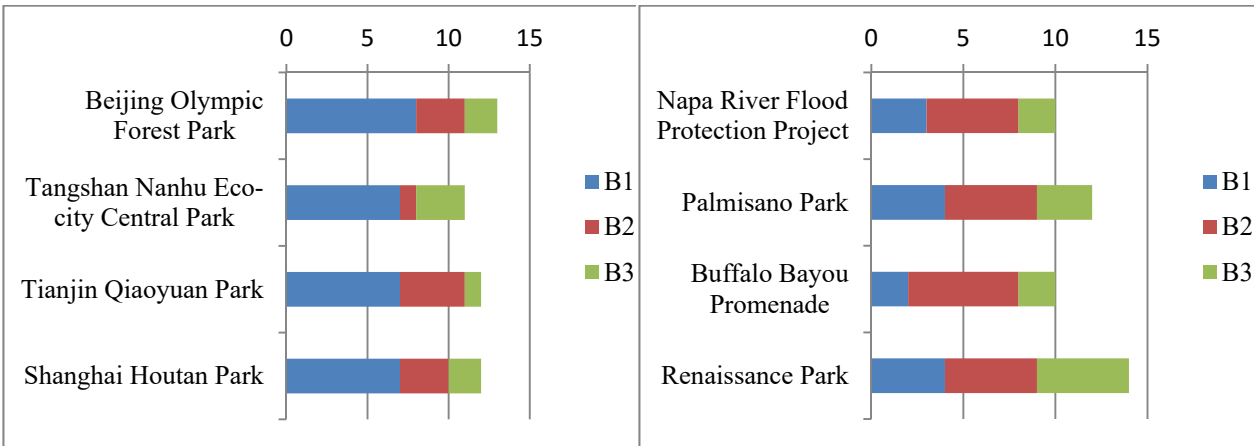
## 4 RESULTS

### 4.1 Various benefit composition of projects in China and U.S.

The result of comparing benefit composition of two groups of parks from two countries is shown in Table 4. As Figure 1 and 2 suggested, a certain phenomena is revealed: the environmental benefits figures in the four parks in China are more than the correspondent figure in the four parks in the U.S., almost double; while the parks in the U.S. have generally higher social benefits than those in China, their economic benefits are slightly over as well. Thus, in terms of the benefit composition characteristics, the Chinese parks have outstanding environmental benefits with great breadth, considering various comprehensive ecosystems including water, climate, animals and plants, resources and so on; but their social benefits are relatively simple in relation to providing some recreation and outdoor environmental education services, and the economic benefits of each park are thin as well. Comparatively, parks in the U.S. are distinct from China, of which the social benefits are highlighted, the economic benefit is richer, but the environmental benefits not as comprehensive as China's.

**Table 4.** Project Ratio of three benefits number in two countries

Country	Project	$B_1$	$B_2$	$B_3$	$R_b$
China	Beijing Olympic Forest Park	8	3	2	8:3:2
	Tangshan Nanhu Eco-city Central Park	7	1	3	7:1:3
	Tianjin Qiaoyuan Park	7	4	1	7:4:1
	Shanghai Houtan Park	7	3	2	7:3:2
The U.S.	Napa River Flood Protection Project	3	5	2	3:5:2
	Palmisano Park	4	5	3	4:5:3
	Buffalo Bayou Promenade	2	6	2	2:6:2
	Renaissance Park	4	5	5	4:5:5



**Figure 1.** Diagram of Ratio of three benefits number of Chinese projects

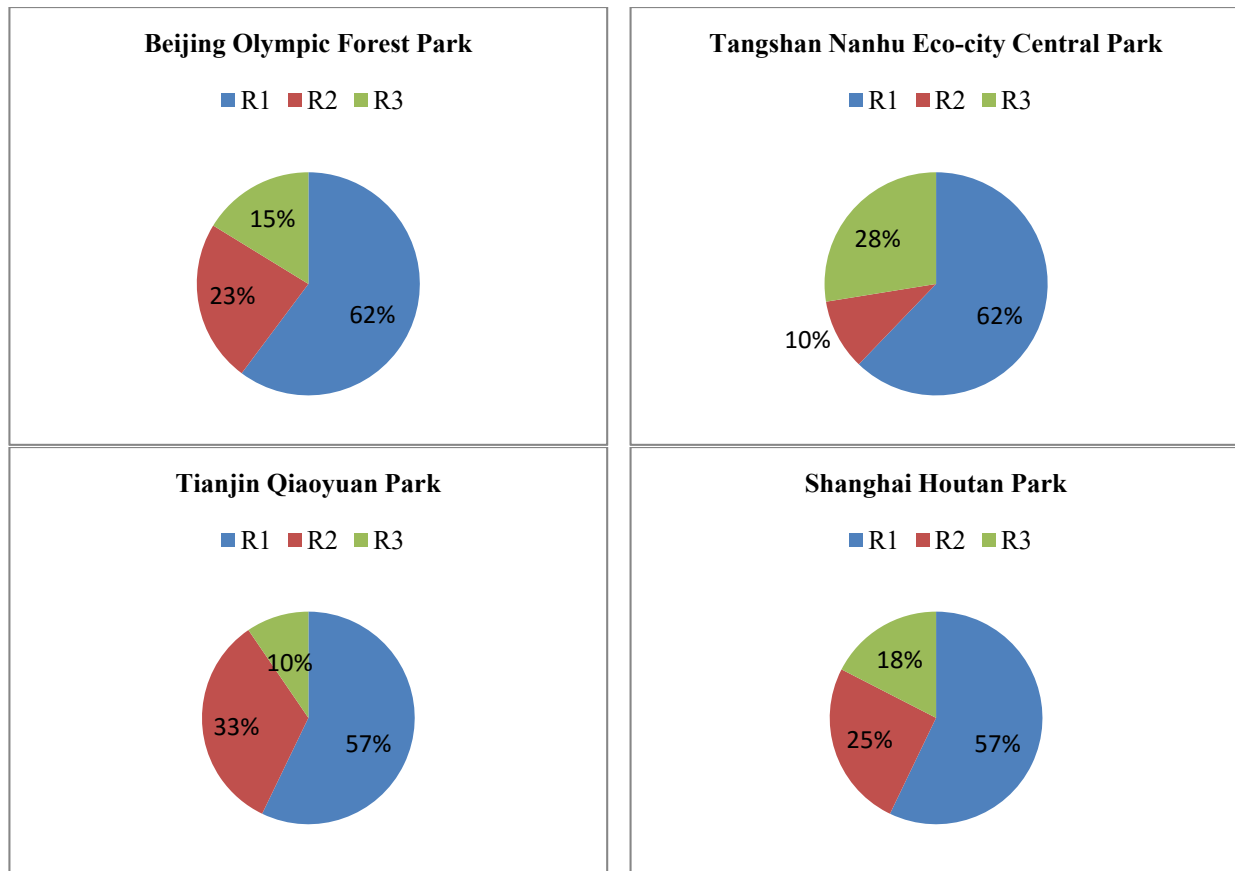
**Figure 2.** Diagram of Ratio of three benefits number of American projects

#### 4.2 Common benefit composition of projects in China

Further, concerning the ratio of the number of each type of benefit to the total benefits number in a project, there are similar results in the four China's parks (see Table 5 and Figure 3). Generally, in these parks, the proportion of environmental benefits are similar, up to 60%, the proportion of social benefits are most at 25%-35%, and the proportion of economic benefits are at 15%-30%, averaging around 17%. Consequently, model sustainable parks in China have a common benefit composition: high environmental benefits is twice more than social and economic benefits, which are relatively low, and the economic benefits are comprised by indirect economic benefits resulted from environmental benefits.

**Table 5.** Project ratio of each type of benefit number to the total benefits number in China

Project	R1	R2	R3
Beijing Olympic Forest Park	8:13	3:13	2:13
Tangshan Nanhu Eco-city Central Park	7:11	1:11	3:11
Tianjin Qiaoyuan Park	7:12	4:12	1:12
Shanghai Houtan Park	7:12	3:12	2:12

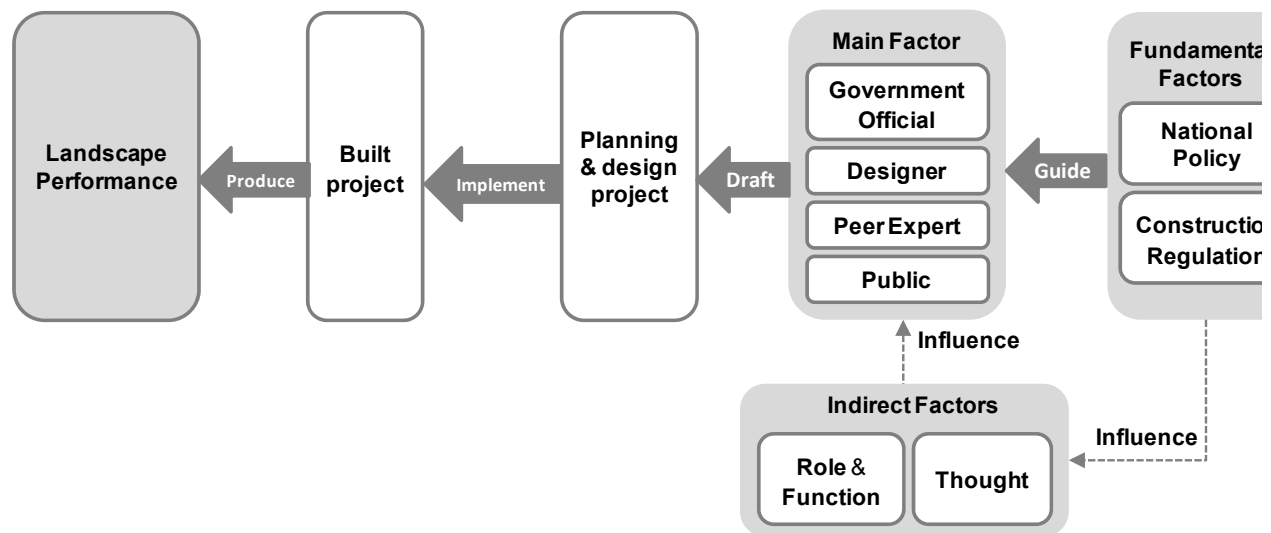


**Figure 3.** Diagram of Project Ratio of each type of benefit number to the total benefits number in China

Thus it could be noted that: 1) within various social contexts, there are various performance preference in landscape projects, where the social benefits of urban parks in the U.S. are highlighted, and the parks in China are more serious about environmental benefits; 2) within the same social context of China, the projects' performance preference are consistent, where the environmental benefits are high, and social and economic benefits are lower.

## 5 DISCUSSION

This research suggests that the four urban parks in China have common performance preference, of which the environmental benefits are higher than social and economic benefits. To further explore whether this preference is universal in current Chinese social context, and what are the potential impact factors, this study drew up the hierarchical influence factor diagram of landscape performance (see Figure 4) with the general rules. According to this diagram, firstly, the dominant factors of the four subjects, including government official, designer, peer expert, and the public, were analyzed about the relationship between their works and the landscape performance in the built project. Then the paper discussed the potential common characteristics of their preference and behavior, so as to define the universality of the social preference. Finally, it explored the impact factors of the social preference on the national level.



**Figure 4.**Diagram of Hierarchical Influence Factors of Landscape Performance

### 5.1 Dominant impact factors of performance preference in the case projects

Generally speaking, the four subjects, including project owner, planner and designer, program reviewer, and user, jointly affect the final form of urban landscape projects. To China, these subjects are government official, landscape architect, peer expert, and the public. Accordingly, the paper through literature review from website news and published papers, obtained relevant data and compared these subjects' particular works in the process of four parks construction in China with the preference results. However, due to the restriction in research, it lacks experts' evaluation opinions and public comments.

In detail, we sum up the projects' building objectives and tasks drawn up by policymakers (the design objective is in accordance with the upper master planning), as well as the design strategies put forward by landscape architects in program design phase. Besides, these data were classified into three environmental, social, and economic strategy categories, and then, compared with the performance results of project built, so as to show how these dominant factors affect the final performance after projects built, due to their preference for the design targets and strategies.

The summary results of building objectives and design strategies are shown in Table 6 and Table 7. Known from these, in terms of program orientation, the local governments greatly focus on ecological environment within green city, restoration of degraded land, as well as human well-being, which reveal that they pursue much environmental and social benefits, but little economic benefits. As to the designers of these park cases, the three types of strategies put forward are largely in agreement with the result of the performance towards the built parks; therefore, it is shown that these strategies have fulfilled their intended purposes, one strategy may cause multiple benefits. Whereas, there were limited economic strategies, around saving cost, were raised systematically in the design phase, as a result the economic benefits are low in the final performance. What is more, it needs to be mentioned some strategies were not reflected in the result of performance evaluation, so there were some potential benefits unconsidered by the evaluators. It could also be a recommendation for later evaluator to combine the design strategies within the evaluation process.

**Table 6.** Project orientation of four parks in China

Project	Project orientation
Beijing Olympic Forest Park (BMCUP, 2003)	Construct forest park a green and ecological area to become a part of green screens between urban and rural areas of Beijing, in order to improve the urban environment and climate, and provide entertainment and leisure for the general public.
	Reflect the theme of "Scientific Olympics, Green Olympics, Humanistic Olympics".
Tangshan Nanhu Eco-city Central Park (CECA, 2010)	Build the mining subsidence area into urban new district of beautiful and ecological environment and Humanism, that will be a central park in the future.
	Municipal recreation Park
Tianjin Qiaoyuan Park (LC, 2009)	The key project of urban environment transformation program in Tianjin, that is built to provide an excellent recreation area for residents around and include a bridge museum and some 1000 m <sup>2</sup> commercial areas at least.
Shanghai Houtan Park (Editorial S., 2009 )	Part of the core green space in the Expo Site; show the Expo theme of ecology, science and technology, Humanism
	Stick to the Expo theme of "Better City Better Life"; Achieve the strategic target of "Green EXPO and Ecological EXPO".

**Table 7a.** Design Strategies and Benefits Matrix of Beijing Olympic Forest Park (Hu et al, 2006)

Strategy classification	Benefits Strategies	Carbon Sink	Water Saving	Energy Conservation	New Energy Resources	Sewage Disposal	Animal Habitat	Biodiversity Protection	Stormwater Management	Recreation	Outdoor Teaching	Job Creation
Environmental Strategies	Plant Diversity Design	●	-	-	-	-	○	●	-	-	-	-
	Native Plant Protection and Reconstruction	●	-	-	-	-	○	●	-	-	-	-
	Provide Habitat for Wild Animal and Build Swift Tower	-	-	-	-	-	●	●	-	-	-	-
	Water Purification System	-	●	○	-	○	-	-	○	-	-	-
	Eco-wetland Landscape	-	-	-	-	●	○	○	●	○	-	-
	Green Energy	-	-	-	●	-	-	-	-	-	-	-
	Energy-saving Building	-	-	●	-	-	-	-	-	-	-	-
Environmental & Economic	Waste Recycling	-	-	●	-	-	-	-	-	-	-	-

Strategie s													
Social Strategie s	Landscape Experience and Recreaion	-	-	-	-	-	-	-	-	-	●	-	-
	Wetland as Education Center	-	-	-	-	-	-	-	-	-	-	●	-
	Children Playgrounds	-	-	-	-	-	-	-	-	-	●	-	-
	Fire Protection Design of Forest Park	-	-	-	-	-	-	-	-	-	-	-	-

**Table 7b. Design Strategies and Tangshan Nanhu Eco-city Central Park (BTUPDI, 2011; Hu, 2014)**

Strategy classifcation	Benefits Strategies	Carbon Sink	Climate Regulation	Animal Habitat	Biodiversity Protection	Water Ssavin g	Waste Gas Treatme nt	Waste Recycli -ng	Recreation	Commer ci-al Taxation	Land Value Promotio n
Environm -ental Strategie s	Reclaimed Water as Supplement	-	-	-	-	●	-	-	-	-	-
	Build Water System and Wetland Based on Existent Fishpond and Subsidence Places	-	○	-	-	●	-	-	-	-	-
	The existent plant Reservation and Native Plant Design	●	○	○	●	-	-	-	-	-	-
	Build Wooden Architecture and Reduce Emission and Resources Consumption	-	-	-	-	-	-	-	-	-	-
Environm -ental & Economi cStrategie s	Industry Waste Treatment and utilization and Trash-filled Mountaion	-	○	-	-	-	●	●	-	-	○
Social Strategie s	Create Green Space for Public Recreation	-	-	-	-	-	-	-	●	-	○

Environm-ental & Social Strategies	Connect with the Central Park by Green Corridor	-	-	-	-	-	-	-	●	-	●
Economic Strategies	Cost Saving	-	-	-	-	-	-	-	-	-	-
	Business Taxes	-	-	-	-	-	-	-	-	●	-
	Enhance the Land Value	-	-	-	-	-	-	-	-	-	●

**Table 7c. Design Strategies and Tianjin Qiaoyuan Park (Yu et al, 2009)**

Strategy classification	Benefits Strategies	Carbon Sink	Soil Improvement	Animal Habitat	Native Biodiversity Protection	Stormwater Management	Pollution Treatment	Waste Recycling	Noise Reduction	Recreation	Outdoor Teaching	Environmental Education
Environmental Strategies	Topographical Design Combining the Rainwater Collection System	-	○	-	-	●	-	-	-	-	-	-
	Rescue the of Field Trash	-	-	-	-	-	-	●	-	-	-	-
	Choose Adaptability Plant by Dynamic Seeding	●	-	○	○	-	-	-	-	-	-	-
	Biodiversity Protection	-	-	●	-	-	-	-	-	-	-	-
	Restore the Characteristics of Regional Landscape	-	-	○	●	-	-	-	-	-	-	-
Social Strategies	Recreation System Design	-	-	-	-	-	-	-	-	●	-	-
	Advocate Ecological Esthetics	-	-	-	-	-	-	-	-	-	-	○
	Environmental Interpretation Design	-	-	-	-	-	-	-	-	-	●	●
Economic Strategies	Low Cost	-	-	-	-	-	-	-	-	-	-	-

**Table 7d. Design Strategies and Shanghai Houtan Park (Yu, 2010a; Yu, 2010b)**

Environmental strategy	Benefits Strategies	Carbon Sink	Sewage Disposal	Animal Habitat	Native Plant Protection	Water and Soil Conservation	Water Saving	Waste Recycling	Recreation	Science Education	History and Culture Memory	Maintenance Cost
------------------------	------------------------	-------------	-----------------	----------------	-------------------------	-----------------------------	--------------	-----------------	------------	-------------------	----------------------------	------------------



Environmental Strategies	Absorb Carbon Dioxide	●	-	-	-	-	-	-	-	-	-	-
	Purify the Contaminated Land and Water	-	-	-	-	●	○	-	-	-	-	-
	Sustainable Flood Control System	-	-	-	-	●	-	-	-	-	-	-
	Provide Habitat for Native Plant and Animal	-	-	●	●	-	-	-	-	-	-	-
Environmental & Economic Strategies	Waste Recycling	-	-	-	-	-	-	●	-	-	-	-
Social Strategies	Create Path System with Landscape Experience	-	-	-	-	-	-	-	●	-	-	-
	Create Historical and Ecological Site	-	-	-	-	-	-	-	-	○	●	-
Economic Strategies	Low Maintenance Cost	-	-	-	-	-	-	-	-	-	-	●

Note: “●” represents strong connections; “○” represents some kind of connections

As to peer expert, though, without their review data, viewed from the review organization of the projects in Chinese city construction industry, the reviewers belong to expert designers from well-known design agency and university in the field. Thus, these programs of built landscape were approved and suggested by peer experts, and the final design strategies were in accordance with their opinions. As to the public, there are two forms of participation: one way is to vote and give comments on several optimal design plans reviewed by Expert Evaluation Commission, Beijing Olympic Forest Park being in this way (BMCUP, 2003); another way is to show the final plans assessed by peer experts, and give comments in a period of time, the other three parks (CECA, 2010; LC, 2009; Editorial S., 2009) being in this way. Thereby, the public were limited to express their opinions, having little impact on the projects.

Overall, the result of built project depends largely on its planning and design, which are determined by the four dominant subjects to a different extent. Generally, the expert owns the selection right, who could select several optimal plans and provides suggestions to government or related institution. However, the voting right of the public is lack of rule, depended on the approval processes settled by government. The government also has the decision-making right about the ultimate implementing plan. Through the comparative analysis between the four park cases and their subjects relatively, it is demonstrated that the subjects do affect the performance preferences of these projects relatively, which remain consistent.

## 5.2 Common impact factor of the subjects' preference

In order to make clear that the social preference is common in Chinese current context, the paper explores the common impact factors behind the subjects' behavior preference, and argues that factors are up to the subjects' roles and function given in the landscape project, as

well as their thought on the behalf of different social interest groups. Therefore, this discussion is conducted in the two aspects of roles and function, and thought.

### 5.2.1 Roles and function of the four subjects and their interest

According to the construction and management mode of urban landscape project in Chinese social context, the four subjects own their specific roles and function (see Figure 5). For providing the construction fund of the project, the government officials have the development and decision-making right. In general, basing on the land development plan, they draft the basic design task statement for a construction project, and hold the decision power throughout the project, affecting the result of project fundamentally. As the direct exporter of the design plan, the landscape architects determine the ultimate form of the project, by their design ideas and strategies. Besides, the experts have the selection rights and suggestion rights partly, so their professional attitude and preference affect the result of the project in a certain degree. And the public, as the direct user and taxpayer, have the voting right and suggestion right, yet they could exercise their rights just in the publicity step after the plan formed, so it results in their influence being relatively weak.

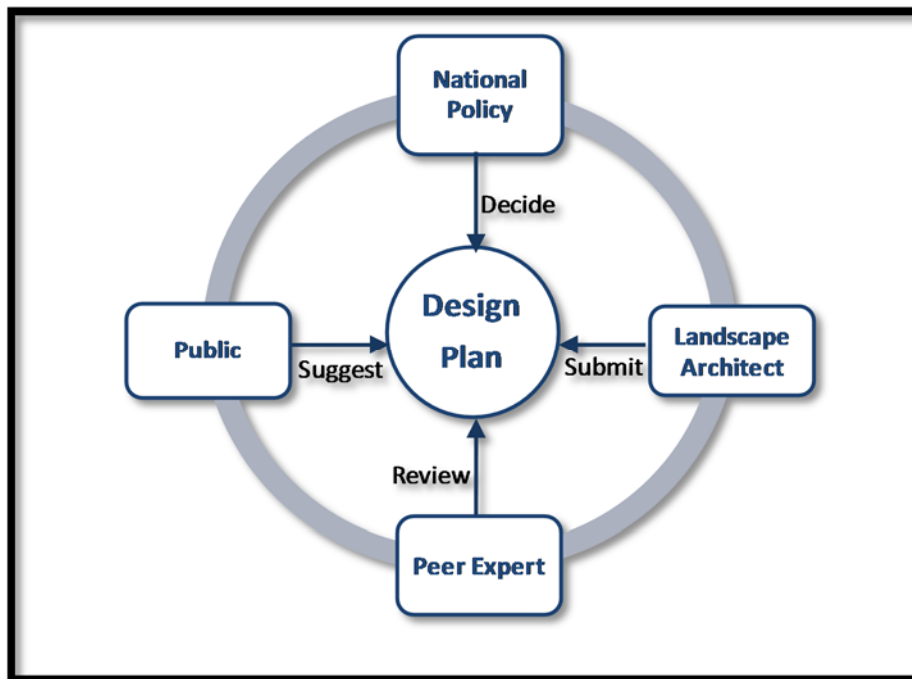


Figure 5. Role and Function of Four Subjects in Project Phase

Additionally, as the functional distribution, each subject stands different social interest group, which induces the common preference of each group. In the project of urban comprehensive park as the public welfare infrastructure, the interest of government lies in investment returns and political achievement; the interest of designer lies in their plan being approved and implemented, and promoting their professional attitude; the interest of expert lies in the evaluation work (Hu et al, 2006), doing selection and suggestion, while the expert has multiple identities, as designer uninvolved in the project plan, commissioned by government to review the plan, and also as the public in part, so they play a coordinating role between the three interests of government, designer,

and the public; the interest of the public lies in the result of use after the project built.

### 5.2.2 Thought of the subjects

As to government officials, since urban park does not have direct or obvious economic benefits essentially, and lacks market forces, they always considers controlling and saving cost, neglecting the potential economic benefits and cost-benefit ratio; besides, urban park is an important carriers of political achievements, so they tend to embody the superior leaders' political thought of eco-city construction, highlighting the protection and improvement of ecological environment, and providing recreational place for the general public. For instance, Chou Baoxing (2013), the former vice minister of the National Housing and Urban-Rural Development(NHURD), indicates Ecological Garden City is a new model of sustainable urban development, focused on the improvement of the ecological environment for human settlement; QiangJian (2011), the former deputy director of Beijing Municipal Bureau of Landscape and Forestry (BMBLF), argues the concept of landscape architecture should put the ecosystem services first, united with cultural expression, landscape creation, recreation and so on.

As to designer, the thought is reflected within the professional concept of individual or team. Yu Kongjian and Hu Jie, the designers of these park cases as well as representatives of the excellent landscape architects in contemporary china, follow the sustainable landscape concept in practice, underlining ecological thought and humanities. In their studies, Yu Kongjian (2004; 2007) advocates the beauty of weeds, respecting common culture and humanity, and rebuilding the harmony between people and land; Hu Jie( 2008 )focuses on the combination of the Chinese traditional culture and modern eco-technology in landscape practice.

As to experts, their thoughts are the significant parts of the mainstream thought in the industry. According to a number of academic research, it is shown that the ecological design concept of sustainable development, and achieving harmony between man and nature, is the key thought in contemporary China's landscape industry. Yang Rui (2013), professor at Tsinghua University, indicates modern landscape architecture focuses on ecological diversity and integrity, as well as providing health and safety support services for humanity; Zhu Jianning (2008), professor at Beijing Forestry University, claims that landscape architects should work closely with improvement of ecological environment, within current China's social context of building harmonious society with "conserved resource, friendly environment".

As to the public, the reasonable design of the park is pretty vital to the public user, relatively, whose explicit demands are necessary to improve the social services of the park better. Yet in China the public has few opportunity of participation into the design process, owing to the long-term centralization of power and planned economy in China. Thereby, the public, whose participation is repressed, are becoming sort of acceptable, without strong awareness of social services (Guo, 2004).

Overall, within the specific Chinese social context, the economic benefits are directly affected by government officials, the environmental and social benefits are affected jointly by government officials, designer, and experts, yet the public influence are relatively weak. In addition, as far as the thought behind the subjects' preference, the government officials, designer, experts are all prefer environmental benefits, having specific relating strategies, else concern social benefits conceptually, because of the shortage of public participation and suggestion; however, the economic benefits are also limited, because of the cost controlled by government simply, lacking input-output ratio evaluation. From the above analysis we could see, the four subjects have different roles and functions, distinct interests, and thought, so the commonness of each subject together affect the general performance preference in landscape projects of China.

### 5.3 National policy of social development

It is demonstrated above that the performance preference in landscape projects of China has social universality. From macroscopic level, this social universality is closely linked with national socioeconomic development, thus, the paper tends to explore the fundamental factors affecting this social universality in two aspects: national strategy and construction rule.

#### 5.3.1 National policies related to urban construction in China

With the rapid development of urbanization in China, facing increasingly serious urban environmental pollution and ecological destruction, the urban green space system planning and design is more and more valued by the policy makers and managers.

On November 7, 1998 and July 2001, the Central People's Government of the People's Republic of China, as the supreme department of national administration, made two announcements sequentially about National Ecological Environment Construction Plan and Strengthening the Construction of Urban Greening, which set off a wave of urban green space system planning in domestic large and middle cities. In order to exploring the construction model of urban environmental development that conforms to Chinese national conditions, the National Housing and Urban-Rural Development (NHURD), as the supreme administrative department of urban construction in China, initiated the construction of National Garden City nationwide in 1992 and released officially National Garden City Declaration and Assessment Methods and National Garden City standards on March 25, 2005. After a period of development, these documents were revised, paid more attention to ecological garden city, and new documents of Ecological Garden City Declaration and Assessment Methods and Ecological Garden City standards were issued on November 26, 2012. Besides, there were more various policy documents issued by government in relation to urban biodiversity conservation, wetland conservation, infrastructure development, and so on. Especially on October 22, 2014, *Sponge City Construction Technology Guidelines: Stormwater System Construction with Low Impact Development* was worked out to guide cities to strengthen infrastructure construction based on the idea of ecology and low impact development.

According to the policies published by the supreme administrators, the ecological environmental protection and construction is regarded as an important national policy of urban development in China, aiming at the sustainable development of society and economy based on good protection and construction of urban environment. Instructed by these policies, local government and industry staff would place environmental benefits in the most prominent position in specific construction practice, thus the environmental benefits are greater and apparent in the performance result of Chinese urban comprehensive park.

#### 5.3.2 The regulations of an urban comprehensive park in China

Currently, the *Regulations on Urban Greening* (RUG), originally implemented in 1992, is the only administrative regulations of the urban and rural greening in China (Lin, 2010), and it has played an important role in regulating and guiding the construction of the whole country. Urban comprehensive park is the important component of urban green space, and according to the RUG, the administrative department of urban construction would set the related construction index of urban comprehensive park, and entrust the project to the design units with the appropriate qualification certificates, according to the basic procedures of approval. The stages from design plan, project completion to putting into use shall be subject to approval, acceptance and management by relevant administrative departments. In addition, the business and service stalls in urban parks must apply to the administrative or other authorized unit and be consented.

From the RUG, it is clear about the construction and management mode of urban green space. Accordingly, the comprehensive park is funded by the government; the processes from location, index control, design, construction, to operation, are all managed directly by the relevant

administrative departments. Furthermore, the planners and designers are also commissioned and approved by administrative departments, but there is no rule to support public participation. Therefore, by analyzing the rules of RUG, we can see that the construction and management of urban park are fully in the charge of government, with less market-oriented and little consideration for cost-profit balance and other potential economic benefits; besides, without legal guarantees, the public participation in landscape design is limited. Consequently the social strategies of the project are carried out with little substance, and it is hard to turn the social benefits into reality.

## 6 CONCLUSION

In summary, by taking the cases of four sustainable urban parks in China as empirical research objects, comparing and analyzing landscape performance characteristics from two aspects of different social contexts and the same social context, this paper confirmed that there are different social preference to the performance of the landscape project within different social contexts, and within the Chinese social context the landscape performance preference is characterized by prominent environmental benefits and poor social and economic benefits.

Subsequently, it further deduced the diagram of hierarchical influence factor of landscape performance. Based on the diagram, the comprehensive factors, that affect the performance preference from three progressive levels, were demonstrated. The analysis and study also clarified the universality of the performance preference in the current Chinese social context, and reflected the characteristics and problems of Chinese society and the development of landscape architecture. It indicated that the sustainability, the relationships among the three categories of benefits are not aware comprehensively in the construction of sustainable landscape project in China at present. In terms of the protection and construction of ecological environment, there are solid social consensus and explicit policies to guide, which promotes environmental benefits relatively prominent. By contrast, the considerations of sociality and economy are still inadequate, causing that the final social and economic benefits are not obvious. So for development of sustainable landscape, the potential restriction factors should be faced up, and improved by constantly exploration in practice.

### *Acknowledgements*

This work was supported by State Key Lab of Subtropical Building Science (SKLSBS), Guangzhou Municipal Key Laboratory of Landscape Architecture (GZMKLLA), South China University of Technology (SCUT).

## 7 REFERENCES

- ASLA. (2015a). Landscape Performance Series: Demonstrating the Environmental, Social, and Economic Value of Sustainable Landscapes. Retrieved from <https://www.asla.org/2015awards/96562.html>.
- ASLA. (2015b). Case Study Investigation (CSI): Measuring the Environmental, Social, and Economic Impacts of Exemplary Landscapes. Retrieved from <https://www.asla.org/2015awards/96974.html>.
- Beijing Municipal Commission of Urban Planning (BMCUP). (2003). Regarding the holding of the Olympic Forest Park landscape planning and the central zone scheme collection activities. Retrieved from: [http://www.bjghw.gov.cn/web/static/articles/catalog\\_10/article\\_3048/3048.html](http://www.bjghw.gov.cn/web/static/articles/catalog_10/article_3048/3048.html).
- Beijing Tsinghua Urban Planning and Design Institute (BTUPDI). (2011). Tangshan Nanhu eco-city central park planning and design. *Zhonghua jianzhu bao (China Construction*

Newspaper) 2011-7-12.

- Beijing Olympic Forest Park.(2012). Case Study Briefs. Landscape Performance series by the Landscape Architecture Foundation. Retrieved from <http://landscapeperformance.org/case-study-briefs/beijing-olympic-forest-park>.
- China Eco-Culture Associate (CECA). (2010). Ecological transcendence, the new green dream of Tangshan. Retrieved from: [http://www.ceca-china.org/news\\_view.asp?id=1083](http://www.ceca-china.org/news_view.asp?id=1083).
- Editor Staff. (2009). Shanghai Expo Planning wins the first prize of " National Outstanding urban and rural planning and design ". *Jianzao shi (Construction)*(12),13.
- GUO, Meifeng. (2004). Public participation: an effective method to promote landscape architecture design in China. *Zhongguo yuanlin (Chinese Landscape Architecture)* (1),76-82.
- HU, Jie., WU, Yixia., LV, Lushan. (2006). General Introduction of Beijing Olympic Forest Park Landscape Plan. *Zhongguo yuanlin (Chinese Landscape Architecture)* (6), 1-7.
- HU, Jie. (2014). Tangshan Nanhu eco-city central park planning and design. *Shengtai chengshi yu lvse jianzhu(Eco-city and Green Building)* (4), 110-116.
- JIANG, Xi. (2005). Ecological gap unbridgeable: on the conflict between environment and economy. *Qiusuo (Seeker)* (10), 15-17.
- Landscape China. (2008). Interview with Hu Jie, the main architect of the Olympic Forest Park of ecological practice. Retrieved From: <http://www.landscape.cn/news/interview/2008/0813/65809.html>.
- Landscape China (LC). (2009). Tianjin Qiaoyuan Park. Retrieved from: <http://www.landscape.cn/paper/landscape/2009/1027/94622.html>.
- LIN, Guangsi., YANG, Rui. (2010). Analysis of the urban and rural greening laws in China. *Zhongguo yuanlin (Chinese Landscape Architecture)* (12), 29-32.
- Landscape Architecture Foundation (LAF). (2013a).Landscape performance series. Retrieved from <http://landscapeperformance.org/>.
- Landscape Architecture Foundation (LAF). (2013b).Case Study Briefs. Retrieved from <http://landscapeperformance.org/case-study-briefs>.
- LUO, Yi., LI, Minghan.(2014). How does it change after one year? A comparison of the landscape architecture foundation's published case studies in 2011 and 2012/2013. *Landscape research record* (2):138- 147.
- QIU, Baoxing. (2013). Ecological gardens for beautiful homes. *Zhongguo yuanlin (Chinese Landscape Architecture)* (7), 35-41.
- QIANG, Jian. (2011).Beijing Landscape design theory at the new era. *Zhongguo yuanlin (Chinese Landscape Architecture)* (5), 94-97.
- Scott Campbell. (1996). Green Cities, Growing Cities, Just Cities? Urban Planning and the Contradictions of Sustainable Development. *Journal of the American Planning Association*, 62(3), 296-312.
- Shanghai Houtan Park.(2011). Case Study Briefs. Landscape Performance series by the Landscape Architecture Foundation. Retrieved from <http://landscapeperformance.org/case-study-briefs/shanghai-houtan-park>.
- SONG, Guohui., LI, Yunfeng. (2012).The Effect of Reinforcing the Concept of Circular Economy in West China Environmental Protection and Economic. *Procedia Environmental Sciences* (12), 785 – 792.
- Tianjin Qiaoyuan Park: The Adaptation Palettes.(2011). Case Study Briefs. Landscape Performance series by the Landscape Architecture Foundation. Retrieved from <http://landscapeperformance.org/case-study-briefs/tianjin-qiaoyuan-park-the-adaptation-palettes>.
- Tangshan Nanhu Eco-city Central Park.(2012). Case Study Briefs. Landscape Performance

- series by the Landscape Architecture Foundation. Retrieved from <http://landscapeperformance.org/case-study-briefs/tangshan-nanhu-eco-city-central-park>.
- YU, Kongjian., SHI, Chun., LIN, Li. (2009). Ecosystem Services Oriented Regenerative Design of Deserted Urban Land: Tianjin Qiaoyuan project. *Xiandai chengshi yanjiu (Modern Urban Research)* (7), 18-22.
- YU, kongjian., LI, wei.(2004). Continued to sing the song of the new culture movement: vernacular city and landscape. *Jianzhu xuebao(Architectural Journal)*(8), 85-92.
- YU, kongjian. (2007). Principles and practices of affordable urban green space. *Fengjing Yuanlin (Landscape Architecture)* (1), 55-64.01-0055-10.
- YU, Kongjian. (2010a). The urban landscape as a living system: 2010 Shanghai Houtan park. *Jianzhu xuebao(Architectural Journal)* (7), 30-35.
- YU, Kongjian. (2010b). Landscape design of Houtan Park. *Fengjing yuanlin (Landscape Architecture)* (2), 30-33.
- YANG, Rui. (2013). Discussion on the Contexts and Characters of Landscape Architecture Discipline: Together with a Prospect of Chinese Landscape Architecture at the Beginning of 21st Century. *Zhongguo yuanlin (Chinese Landscape Architecture)* (6), 6-9.
- ZHAO, Jingzhu., LIANG, Xiuying., ZHANG Xudong. (1999). System analysis on the definition of sustainable development. *Shengtai xuebao (Acta Ecologica Sinica)* 19(3), 393-398.
- ZHU, Jianning. (2008). To be a sacred Landscape Architect. *Zhongguo yuanlin (Chinese Landscape Architecture)*(1), 38-42.

#### **Authors' Bio:**

**Yang Yang**, MSc Nanjing Forestry University.

Ph.D candidate of Landscape Architecture, School of Architecture, South China University of Technology, Guangzhou, China. Research interests: Sustainable Landscape planning and design.

**Guangsi Lin**, Ph.D. Beijing Forestry University.

Associate Professor of Landscape Architecture, Associate Chair, Department of Landscape Architecture, School of Architecture, South China University of Technology, Guangzhou, China. Research interests: Landscape planning, design and theory.

**Honghong Zhao**, MSc Tsinghua University.

Professor of Urban Planning, School of Architecture, South China University of Technology, Dean , School of Architecture, Guangzhou College of South China University of Technology, Guangzhou, China. Research interests: Urban Design.



COUNCIL OF EDUCATORS  
IN LANDSCAPE ARCHITECTURE

*A CELA Conference Presentation*

*Abstract ID: 121*

## THE DILEMMA OF THE EDGE: EXPANDING OUR LANGUAGE FOR COASTAL INTERVENTION

### **VANCE, NANCY**

School of Landscape Architecture, Lincoln University, Christchurch New Zealand  
[nancy.vance@lincoln.ac.nz](mailto:nancy.vance@lincoln.ac.nz)

### **BOWRING, JACKY**

School of Landscape Architecture, Lincoln University, Christchurch New Zealand  
[jacky.bowring@lincoln.ac.nz](mailto:jacky.bowring@lincoln.ac.nz)

### **ABBOTT, MICK**

School of Landscape Architecture, Lincoln University, Christchurch New Zealand  
[mick.abbott@lincoln.ac.nz](mailto:mick.abbott@lincoln.ac.nz)

### **1 ABSTRACT**

*Bioretention best management practice (BMP) has gained recognition in landscape design because of its potential in reducing flooding and improving stormwater quality. Based on bioretention design manuals, many laboratory and field experiments have been conducted to explore how bioretention designs influence pollutant removal efficiency. However, conclusions of these experiments are not always convergent. Thus, research on bioretention performance is needed to improve our understandings of design parameters and how they affect pollutant removal performance.*

*The purpose of this study is to use published data to create models in predicting bioretention pollutant removal performance with its design parameters. We compiled bioretention design parameters and corresponding pollutant removal efficiencies from 51 publications, in which 54 records were from field experiments and 66 from laboratory experiments. Key design parameters include the ratio of bioretention surface area to the contributing drainage area (SA/DA), filtration media depth, the presence of mulch layer, internal water storage (IWS) layer and organic matter. Water quality data include influent concentration, effluent concentration, and removal efficiency based on concentration and mass. Pollutants of total suspended solid (TSS), heavy metals, and nutrients are included.*

*We found that overall pollutant removal performance of TSS and heavy metals are fairly stable and consistent. However, removal of nutrients varies greatly, which is attributed to leaching of nutrient from soil. Statistic tests indicate that total nitrogen (TN) removal can be predicted with sand/soil media depth, SA/DA, the presence of IWS and organic matter. Organic matter has a negative impact on TN removal performance because of leaching of nitrogen from soil. Other factors are all positively-related factors. Total phosphorous removal can be predicted with sand/soil media depth, SA/DA and the presence of IWS where the presence of IWS has a negative impact and all other factors have a positive impact on pollutant removal efficiency. Heavy metal removals can be improved with thick media layer and the presence of mulch layer. TSS removal is positively associated with the presence of mulch.*

---

The authors are solely responsible for the content of this technical presentation. The technical presentation does not necessarily reflect the official position of the Council of Educators in Landscape Architecture (CELA), and its printing and distribution does not constitute an endorsement of views which may be expressed. Technical presentations are not subject to the formal peer review process by CELA Track Chair System; therefore, they are not to be presented as peer-reviewed publications. Citation of this work should state that it is from a CELA conference paper. EXAMPLE: Author's Last Name, Initials. 2014. Title of Presentation. CELA Paper No. 14-xxxx. Baltimore, Maryland: CELA. For information about securing permission to reprint or reproduce a technical presentation, please contact CELA at [dsolco@uta.edu](mailto:dsolco@uta.edu) or 817-272-2321.



## 1.1 Keywords

landscape, seascape, coast, threshold, design, intervention

## 1 INTRODUCTION

Intervening in the coast is a dilemma for landscape architecture. While there is a profound pull towards the coast for settlements around the world and throughout history, rising sea levels, storm surges and flooding events are providing new challenges regarding the rationale for designed interventions. Like all edge conditions, the coast is a place of heightened intensity: a place of recreation and consumption and with it a place of heightened personal perceptions and qualities of wellbeing. Civilisation has been drawn to the sea's edge for centuries, where communities have appeared and disappeared over time. Attraction to this edge between land and sea is driven by multiple factors including ease of trade, transport and physical and spiritual nourishment.

Dramatically increasing population growth occurring in coastal megacities and rising sea levels are at the core of the dilemma facing cities in this century. Approximately 40 million urban residents globally are exposed to 1-in-100-year extreme coastal flooding events, and by 2070, this will increase to 150 million people (Nicholls et al. 2007). Noted also that increased climate volatility has led to a shortening of intervals between these so-called events such that recent studies in New Zealand indicate these are likely to become the new norm (Parliamentary Commissioner for the Environment, 2015). This is especially vivid in Christchurch, New Zealand, which experienced 50 years of sea-level rise 'overnight,' as a consequence of the earthquakes of 2010 and 2011 (Copley et al, 2015).

An engineering mindset might suggest that the best strategy is one of defence, invoking an almost military-like stance against the 'enemy' of the sea. Significant importance has been placed on holding this edge, including an economic imperative in the value of land being protected hence the implementation of costly seawalls and bulkheads to protect assets and infrastructure. Yet any sense of permanence is illusory: IPCC forecasts stress the inexorable shift in coastlines that is underway. The scale of challenge and quality of temporariness in all that is built becomes evident when the ways communities have appeared and disappeared over time is considered. These time shifts are multiple and range from the tangible – six hours being the span of tidal variation and sixty years the span of a person's remembered observations – to the abstract: from six hundred years where a re-ordering of civilization may take place to six thousand years when the first cities began to take form.

In this context, how should landscape architecture orientate itself? In letting an environment continue to take and make its shape how then to intervene? Rather than fortifications and ever higher walls, we propose a conversational, invitational, empathetic response. We ask, in what ways can landscape architects imagine possibilities for an ongoing engagement in the zone between land and sea? Yet in asking this we are acutely aware of the complexity of this zone, and that it is not a simple line of demarcation between wet and dry. Rather, it is a rich and imbricated, made up of continuums through space and time. We seek out a framework for thinking about interventions in this zone, and speculate on other possibilities that transcend the merely physical, exploring other ways of 'owning' and occupying these temporally complex areas. The sea is coming into the land, and with it coast, rather than retreating, is thickening as a greater range of relationships is required. Some of these might be changes to concepts of land ownership, to recognise that owning land in a dynamic environment is counterintuitive (Copley et al, 2015). Perhaps roads become urban waterways and slowly submerging landscapes are enhanced to 'read' more clearly for navigation (Copley et al, 2015). Our approach is to raise our heads above the immediate challenge of the next flood or the next storm surge, and shift our gaze to the long

term, of how we might overcome our fear of the sea coming onto land and instead embrace the possibilities.

In this paper we explore how this threshold between land and sea might be re-conceptualized as a place of exchanges and reciprocity, a place of yielding and retreat, a place of respect and understanding. Using a typological model which echoes the *Inside Outside* work of Berrizbeitia and Pollak (1999), the potentiality of this threshold space is navigated in design terms, and with it a critical frame that places landscape architecture within the range of temporal arcs which relate to the here and now, but more importantly to what is to come. Pointing to the writing of Jane Flax, Berrizbeitia and Pollak recognise how transitional thinking – of the means of bridging disciplines in their case – “sometimes requires the invention of a new language.” (1999, p.11). For Flax, transition was part of the bigger shifts in relationships and relativities as part of the unsettling of Enlightenment ideals. In our looking at the coast we are also concerned with the unsettling of the seemingly immutable ideas from the past, of the confidence in engineering, and even in the boundaries between disciplines which have allowed the coast to fall into a non-man’s land, after all, should landscape architects be working in the sea? Another transition is also inexorably unfolding, as the sea moves ever landward. This dilemma of the coastal zone is one which is pressing and demands, we would argue, the very best of landscape architectural thinking, our stewardship, our understanding of complex systems and our capacity for innovation.

## **2 A STUDY OF INTERVENTIONS IN COASTAL NEW ZEALAND**

In August 2015, 40 students and staff from Lincoln University’s School of Landscape Architecture embarked on *COAST*, a 5-day examination of the places where land and water mingle and meet. Its focus was to study first-hand the natural processes, cultural dimensions and design interventions at play along the coastline of Canterbury on the east coast of New Zealand’s South Island. Themes including the identification of land/sea thresholds, the properties and qualities of built interventions, and the experiences they both direct and afford were each considered, and with a goal to consider how landscape architects could better facilitate people’s experiences of the coast and also the coast’s capacity to further shape human activities. While this field trip focussed on existing conditions, part of our broader concern is an expansive appreciation of coast, the building of a new language that offers greater temporal and spatial potential, recognising the shifts occurring in that place where land and sea come together.

A subtle reading was sought with investigations focused on Massey’s framing of places as ‘moments’ (1991), where she argues that, instead then, of thinking of places as areas with boundaries around, they can be imagined as articulated moments in networks of social relations and understandings, but where a large proportion of those relations, experiences and understandings are constructed on a far larger scale than what we happen to define for that moment as the place itself, whether that be a street, or a region or even a continent. And this in turn allows a sense of place which is extroverted, which includes a consciousness of its links with the wider world, which integrates in a positive way the global and the local. (1991, p.28)

We are not looking, then, at the simple line of the coast, but a much broader array of relationships, both physical and cultural. In the typology below we provide some thinking towards these expanded linkings through time and space. Ordered alphabetically the following ‘types’ were observed:

## 2.1 Boat Ramp



**Figure 1** Boat ramp

A familiar coastal intervention, the boat ramp offers a sheltered and smooth concrete surface from which to safely launch a boat. In plan view it extends perpendicularly across the tidal zone, spanning dry static land with tidally-influenced fluctuating and liquid sea. Swell movement washes up and down its smooth surface., while evenly spaced piles, structurally retaining a boardwalk, line the edge creating a sense of rhythm to the movement across this threshold and spatially define the upwind edge. Generally not aligned on an axis to offer any structural properties or aesthetic qualities, the boat ramp concedes to water depth and wind direction. In sectional view the boat ramp vertically sutures static elevated land through the water's surface to its depths offering enough draft to launch a recreational vessel at any time of day. This structure perforates the rocky stabilizing bank and allows passage from the terrestrial-centric 'outside' to the aqueous 'inside', creating a continuity between the two states and spaces. This resonates with Assefa's inside-outside relationship of interpenetration where architecture projects into landscape creating a continuity between the two (Assefa, 2003). In the broader sweep of time the boat ramp offers an intriguing, infinitely adjustable relationship between coast and sea. This prospect of accommodating constant variability deftly counters an either/or condition, and with rising sea levels, a boat ramp might be extended infinitely inland, as articulated moments.

## 2.2 Breakwater



**Figure 2** Breakwater

Sometimes called a groyne or mole, a breakwater is a barrier built out into the sea to protect a coast or harbour from extreme wind and swell. It is formed from a solid layering of material, building up land in a linear arrangement, parallel to shore, to a finished level either

underwater, an artificial reef, or surfacing above high tide and attached to shore creating a causeway. This structure also delineates between two experientially different spaces, one open and exposed to the forces of wind and waves and another of interior calm shelter, where the raised causeway portion wraps round an inner harbour deflecting wave energy back out to sea. This perception of a controlled environment is challenged only by the nature of water to move vertically as well, over larger timeframes, as storm surges, tsunamis and sea level rise. In this dynamic setting, a breakwater might provide a false sense of security. In its defensive form and with its seemingly protective 'arm,' the breakwater masquerades as being invincible. Yet, in its static form it presupposes a knowing of an ultimate limit. Memories of tsunamis topping the walls intended to protect Japanese settlements come to mind. The breakwater represents a way of thinking that is ripe for innovation. Can the function of a breakwater – to provide shelter in a harbour – be mobilised? Might a breakwater be responsive to shifts in the dynamic coastal setting?

### 2.3 Buoy



**Figure 3** Buoy

A mooring buoy on a plan is a dot, a static pinpoint locating a navigational hazard or identifying ownership of 'a boat parking spot' to the chart-reader. Spatially the foam-filled plastic ball floats on the water's surface and occupies an area scribed by the extent of its movement around its tether, which is anchored to the sea floor. It tries to delineate a space in a moving medium, with landscape below (seafloor) and the architectural features of landscape above, a vessel where one can eat, sleep and recreate. This dynamic nature of securing an object respects the environmental forces around it, and offers experiences of buoyancy, of movement and of appreciating climatic conditions. A boat on a mooring as abode gives an added dimension to human habitation, where the confining traditional materials of a house on land are altered to buoyant and ever-changing environmental forces of wind, current and waves. Here the environment invites participation, and the boundaries between land and sea dissolve, as Bishop and Bowring relate a relationship of dissolution between architecture and landscape (2001). Responsive to the datum of the sea's surface, the buoy as a piece of land afloat offers infinite variability. Even if everything is submerged, the buoy remains, bobbing on the water's surface, offering a place to tether. There is a type of reciprocity between the land and sea with the buoy, an occupation of one realm by another, albeit on the sea's terms. The buoy speaks to the local moment in space, and the broader shifts in sea levels; it is a moment rather than a boundary.

### 2.4 Derelict Piles



**Figure 4** Derelict piles

Derelict piles stipple coastlines where structures once stood, they are revealed and hidden with each tide. So as to not further disturb the ecology of the tidal zone these are left, like beacons, signalling the form, mass and elevation of structures consumed by the elements. This temporal reading is coupled with the appreciation of the forces which weathered away the original structure and the rhythmic predictable pattern created by the vertical forms like vertical needles stitching the earth, sea and sky. Where on land a derelict structure is generally removed to make way for new, the regulations on ownership of the coastline are strict and such that if not rebuilt upon often a memorial skeletal form remains, like a shipwreck, becoming a form of coast itself. Derelict piles offer a temporal marker, they remind us that sea and land do not mean as a line of constancy, but as a dynamic and interconnected complex. As this zone continues to change there may be more and more derelict piles, alongside other damaged and abandoned structures, acting as warnings, as cautions against presuming land's hegemony over sea.

## 2.5 Dry-dock



**Figure 5** Dry-dock

As a projection of sea into land, a dry-dock is an inversion of a jetty or pier. This narrow basin which when filled with sea water floats a ship into the dock then drains for ship to rest on hard surface. This resonates with the destabilizing of the architecture and landscape boundaries, through the strategy of displacement as "internalization" of the canal structure on shore (Bishop and Bowring 2001). There is a contrast of materials: water, the fluid medium with buoyant properties, against the massive structural materials and forms necessary in which to contain it. A controlled exchange of water floating in and water draining out of this fixed form presents a a continuum of material, movement and time, blurring any distinguishable edge to the coastline.

Like the derelict piles, dry-docks too are susceptible to abandonment. At certain times the dry-docks will be overcome by the sea and redundant. The necessary relationship between wet and dry will become dysfunctional, pointing again to the need for responsive interventions, a decoupling between superseded concepts of how form might follow function.

## 2.6 Ferry Terminal



**Figure 6** Ferry terminal

A small community's ferry terminal is a jetty structure projecting out into the sea, offering safe ferry boat access from its elevated position and deeper depths at its terminus. The jetty is bound by railing affording passengers comfort in approaching the edge and is a thin boundary which is punctuated by steps and ramps, the steps with wider than normal treads, almost processional and drawing attention for careful footing. At high tide only a couple of steps meet the ferry's deck, while at low tide many wet slippery steps are negotiated for access. An awareness of tidal cycles and marine qualities is threaded into the passenger's commute.

While the access onto the jetty is linear and narrow, the terminal space widens opening into a space, a destination. All sides of the structure have a means of entering and exiting the water, providing a jumping platform (gaps in the railing), swing (derelict goods crane with rope), steps and ramp, facilitating a multitude of experiences of being on and/or in the sea. This experience of sea is heightened for swimmers who venture under the decking as swell causes the space between water surface and underside of decking to shrink and expand, and with water's force swirls the water, and swimmer, around and between piles heightening an embodied experience of sea.

As a coastal transport node, the ferry terminal is a place of arrival and departure, a gateway to the community, and with the vibrancy of these activities and social life is the land equivalent of a main street.

The ferry terminal responds to current technology. Whatever form the ferry takes, the ferry terminal must accommodate it. Even in presuming a ferry must run is challenged in the frame of articulated moments, where looking to broader social relationships, the reduced need for travel may transform the ways in which a harbour is traversed.

## 2.7 Fixed Jetty



**Figure 7** Fixed jetty

A vernacular structure of New Zealand coastlines, the fixed timber jetty extends from shore, across shallow flats, and beyond the lowest tides; it enables access onto the water at any time of day while permitting water to freely move below its surface, around and between its structural piles.. A long jetty not only offers a longer processional passage across the top of the water, it may reach far enough from shore to offer a ship's eye view of the surrounding landscape; the visitor is 'in the middle of the harbour', an immersion into seascape while firmly fixed to the ground.

Many jetties were originally built to facilitate trade aboard steamer ships, and therefore have deck cleats at the terminus, rail lines fixed along the decking, and a mechanical winch at the landward end. As derelict features the cleats are today used to tie fishing jigs or recreational vessels, the rail lines emphasise direction and delineate walking to between them, while winches form a bollard preventing motorised vehicle access. The relationship between the fixed jetty and the derelict piles offers a vivid narrative about the temporality of coast.

## **2.8 Floating Jetty**



**Figure 8** Floating jetty

A floating jetty is one where a floating concrete pontoon with galvanised steel ring attachments at its corners moves freely up and down its piles, while an access ramp on hinges allows passengers to access a boat alongside the pontoon at any tidal level.

The structure is buoyant and lifts and lower, creating a variation in the gradient of the access ramp to the pontoon, bellows-like with the cyclic tide; it is relatively level and bridge-like at high tide and dramatically steeper, where one descends to the platform surface, at low tide. The binary relationship between land and sea falls away in this spatial and temporal experience, and there is

a blurring; the floating jetty is participating in something profoundly temporary. Like the buoy and the boat ramp, the floating jetty is responsive, and in tune with the infinite variability of land and sea.

## 2.9 Mussel Farm



**Figure 9** Mussel farm

Mussel farms are New Zealand's major aquaculture industry and are defined on the surface of the water with rows of large black buoys and lights at all corners, and underwater they resemble an agricultural paddock growing crops of mussels onto grids of longlines, anchored in place on the sea floor. The linear buoy arrangement demarcates a subdivision of the sea, and like the mooring buoy intervention above, has a dynamic boundary, albeit on a tighter tether. A vertical longline layer is hidden in the murky waters below the horizontal buoy layer, suturing seafloor with surface, and stretching the threshold of, not land and sea but of landsea or sealand. The mussel farm offers an expansive potential for relationships, with its reciprocity, its insertion, of a land-ish concept within a sea setting.

## 2.10 Pier



A 300m long concrete pier sits 7m above high tide on twenty 1.5m diameter concrete piles. This pier's massive scale responds to the long stretch of coastline it projects perpendicular from, and offers an expansive and elevated perspective across the Canterbury Plains to the Southern Alps, and across Pegasus Bay to the Seaward Kaikoura range. Walking on the pier means moving out of a usual land-bound condition, into being suspended in the sky above the sea, confounding



the boundary between the two; the pier is a place of becoming, it amplifies possibilities for how to find a language for sealand.

### 2.11 Pile Marina



**Figure 11** Pile marina

Contrasting with a pontoon or finger-jetty marina, a pile marina is not connected to land (horizontally) and is accessible only by dinghy. It is 'sea real estate' with the hierarchies of 'land value' reflected in a boat's slip position (variables include susceptibility to wake, exposure to collision and windward position). Like a mussel farm, in plan view it is a series of dots, underwater in sectional view piles are driven into the seabed. The piles stand vertically without bracing and boats secure a central position with lines between four of them. As there are no floating pontoons, the lines must accommodate a rising and falling tide. The marina offers a sense of security and permanence to a boat's position as it is bound to four piles, yet the boat is constantly moving: up and down with the tide and shifting fore and aft and side to side in the wind.

### 2.12 Promenade



**Figure 12** Promenade

A seaside promenade is a delineation between land and sea, designed to let pedestrians experience the sea it is a smooth linear path with a solid seawall armoured against coastal erosion. It may also be called bulkheads or revetments and may be built of concrete, wood, steel or boulders, running parallel to the beach, usually displacing the open beach that it is built upon and preventing the natural landward migration of an eroding beach. This line divides the land from sea and creates a binary relationship where a threshold 'between and of' land and sea is operating.

This binary thinking conceived of as a “thick black line” by Solomon (1988) as the one drawn around buildings, separating them from their landscape context.

This structure opposes the sea with mass and reflects its energy back, a protective yet confrontational measure. It has an illusion of permanence due to the magnitude and absolute form. Might the promenade become a water-transport route when this balance of wet and dry changes with time? (see Copley et al, 2015).

### 2.13 Reclamation



**Figure 13** Reclamation

Land reclamation is a form of overlaying, creating new land by filing an area with boulders, cement and soil to a desired finished level. Reclamation creates land, undoing the binary through layering, adding more land and taking away more sea. This reclamation area is Te Awaparahi Bay Reclamation in Lyttelton Harour and is a government-approved 10-hectare reclamation at the Lyttelton Port of Christchurch using clean demolition material from earthquake damaged buildings. Mimicking the natural layering of volcanic materials in the surrounding landscape, it uses the remains of 150 years of civilisation, an abstraction of the native geology. There is a sense of the Sisyphean in attempting to ‘reclaim’ land from the sea, as with every deposition of hard material, there is the sinking sense of interminability – as sea levels rise ever higher.

### 2.14 Steps



**Figure 13** Steps

Steps stitch land to sea and sea to land, suturing the liminal space between the two. They permit stepping into and climbing out of the water (or stepping out of the air and climbing into the air) affording the physical and sensory experience of accessing the amphibian and avian realms. The steps are hidden and a different set revealed with each tide as the lower ones get greener with algae, the top ones get whiter with saltspray, some are wetter or drier than others, and waves of limpet and snail populations transport their homes across the surfaces. A swimmer may even be fortunate to have access to a rope from which to heave onto the lowest step, which is left suspended in the air at low tide.

The steps do not have risers between each tread. The flow of water is permitted in this space allowing the steps to sieve the swell through its fixed structure and invite the sea through its form. This transparency between mediums

Steps have a fluid datum. Just as Venetians have abandoned the lower levels of their homes as the lagoon levels rise, so too can the lower steps be sacrificed to the water. A new language brings new limits, and new terms, where 'ground floor' in Venice now means something different, a flight of steps is always already contingent on the water's level.

## 2.15 Seawall



**Figure 15** Seawall

The most acute binary relationship is created by the delineation of land from sea by a seawall. This vertical retaining wall reinforces a linear division through changes of material and level, and between land and sea. Although there is still the rise and fall of the tides against a seawall revealing a zone of coasting, the seawall is a thin space, one to walk along, sit on, lean on, vault over, or fall off. It directs views perpendicular to the coast, a front and back, where the ocean is always the focus; like a theatre where all the seats face one way. A blurring of this line may be created by varying the scale and texture of materials and varying the levels, and introduce what Bishop and Bowring describe as a "dissolving" of the linear formal arrangement of footpath, then wall, then sea, "the termination of a formal relationship" (2001, p.35), a dissolve of landscape into seascape.

## 3 CONCLUSIONS

The relationship between land and sea has long been considered a static, indelible line. Yet the combined transitional processes of postmodernism's destabilising of boundaries, and sea level rise, demand a new language for thinking about and designing at the coast. Berrizbeitia and Pollak wrote about how the division between architecture and landscape had "not only

impoverished both discourses, it has had a negative impact on the built environment” (1999, p.10). This same counterproductive divisiveness is true of the land and sea. Through their work at the interface of landscape and architecture Berrizbeitia and Pollak offered a new language that allowed for the recognition and imagining of a whole range of possibilities, where before there had simply been an edge. This strategy of plumbing the depths of the normally overlooked has been adopted here at the scale of the coast, where sea meets land, and revealed it as a rich and potent setting. The types of intervention explored in our paper are both analytical and generative. While exploring the ‘how’ of these relationships, we are constantly thinking ‘what if?’ Embracing the possibility of this linguistic expansiveness allows for a shift from the coast as a place where we defend the land from the sea, to a zone of communing, of recognising the intriguing possibilities of the sea coming into the land. Rising sea levels are a dilemma, but through expanding our vocabulary there is a design dexterity, and not a sense of defeat or despondency.

The above attempt to commence a typology of aspects of the Canterbury coast discerns 15 forms of intervention. Of course many more exist both as putative distinct categories and also as overlapping the properties we have chosen to differentiate as a result of this study. Further, the elements included here relate only to physical interventions, but Massey’s concept of the articulated moment reminds us of the much broader ways in which place might be considered. Unsettling containers can mean challenging ingrained presumptions, such as land ownership, and in the face of impending change the need to innovate is urgent (Copley et al, 2015). It also opens up opportunities for innovative design responses such as proposals developed by Lincoln University’s DesignLab ([www.designlab.ac.nz](http://www.designlab.ac.nz)), working with Eden Project Cornwall founder Sir Tim Smit, for an Eden Project in Christchurch New Zealand emphasising this shift in water conditions.

Owen alerted designers to the need to not jump directly to the ‘how’ of designing, but first to ask ‘what?’ (2001). Too often the ‘solutions’ to design ‘problems’ simply rehearse the same old language. Is the only way to negotiate an edge between land and sea to be defensive, to build a wall? After all, what does it mean to hold fast, and also to give, and by whom? Any so-called ‘retreat’ cannot be negotiated by an ever higher wall. Designing must embrace becoming, rather than focussing on a terminal condition. Coast is all about becoming, in the constantly shifting relationships; coast is becoming less distinct, more indeterminate, and increasingly interstitial.

The typology here reflects not the desire for a definitive set of conditions, as might have been Christopher Alexander’s goal with *A Pattern Language* (1977). Rather it is to use this provisional listing to determine which dimensions of sealand and landsea (see Bowring et al forthcoming) interventions match the similar teasing out of architecture and landscape in Berrizbeitia and Pollak’s model. A significant difference between the settings for Berrizbeitia and Pollak’s framework for *Inside Outside* and our work on coast, is the aspect of temporality. Although there will be temporal aspects to the relationship of architecture and landscape as part of the broader sweep of time, for the edge of land and sea time is a fundamental dimension. The language of intervention is therefore not a static language, and is accented by variable tidal conditions and storms, as well as the influence of sea level change.

Our goal here is to expand the landscopic and seasopic language of the coast so that landscape architects (or landseascope architects) might further discern the richness it affords as we organise ourselves to grapple with the challenges brought by a century of rising coastlines, increasing urban populations and the double negotiation with our lived environments they force.

## 4 REFERENCES

- Abbott, M., K. Blackburne, J. Bowring and C. Murphy (2014) Eden Project New Zealand Research and Concept Development Project. *Design and Report for Mountains to Sea Trust and Eden Project Cornwall UK*. Lincoln University DesignLab.
- Alexander, Christopher (1977). *A Pattern Language*. Oxford University Press.
- Assefa, Enku Mulugeta (2003) Inside and Outside in Wright's Fallingwater and Aalto's Villa Mairea. *Environmental & Architectural Phenomenology*, Vol. 14 (2): 11-15.
- Berrizbeitia, Anita and Linda Pollak (1999). *Inside Outside: Between Architecture and Landscape*. Gloucester, Massachusetts: Rockport.
- Bishop, Sarah and Jacky Bowring (2001). Layering, Displacement, Dissolution: Mapping the Spaces between architecture and landscape. *Critiques of Built Works of Landscape Architecture*, 6: 30-37.
- Bowring, Jacky; Vance, Nancy; and Abbott, Mick (forthcoming 2016). 'Between Seascape and Landscape: Experiencing the Liminal Zone of the Coast' in Mike Brown, *Living with the Sea*
- Brown, M and Humberstone, B. 2015. Eds. *Seascapes: Shaped by the Sea*. Surrey: Ashgate Publishing Ltd.
- Carson, Rachel (1998). *The Edge of the Sea*. (originally published 1955). New York: Mariner.
- Copley, Nicki, Bowring, Jacky and Mick Abbott (2015) Thinking ahead: design-directed research in a city which experienced fifty years of sea level change overnight, *Journal of Landscape Architecture*, 10:2, 70-81
- Ingold, T. 2015. *The Life of Lines*. Oxfordshire: Routledge (ISBN 978-0-415-57686-4)
- Krauss, Rosalind (1979). Sculpture in the Expanded Field. *October*, 8: 30-44.
- Massey, D. (1991). A global sense of place. *Marxism Today* (38) 24-29
- Meyer, Elizabeth K (1997). 'The Expanded Field of Landscape Architecture' in George Thompson and Frederick Steiner (eds) *Ecological Design and Planning*. John Wiley.
- Nicholls, R.J, Hanson, S., Herweijer, C., Patmore, N., Hallegatee, S., Jan Corfee-Morlot, Jean Chateau and Muir-Wood, R (2007) Ranking of the World's Cities most Exposed to Coastal Flooding Today and in the Future: Executive Summary. Retrieved 15 December, 2015 from <http://www.oecd.org/env/cc/39721444.pdf>
- Owen, C. (2001). Structured Planning in Design: Information-Age Tools for Product Development. *Design Issues*, 17(1), 27-43
- Parliamentary Commissioner for the Environment. (2015). Preparing New Zealand for rising seas: Certainty and Uncertainty. Office of the PCE, Wellington, New Zealand. Retrieved 15 December, 2015 from <http://www.pce.parliament.nz/media/1390/preparing-nz-for-rising-seas-web-small.pdf>
- Peters, K. 2014. Taking More-than-Human Geographies to Sea: Ocean Natures and Offshore Radio Piracy. In Anderson, J. and Peters, K. Eds. *Waterworlds: Human Geographies of the Ocean*. Surrey: Ashgate Publishing Ltd.
- Solomon, Barbara Stauffacher (1988). 'The Thick Black Line' in *Green Architecture and the Agrarian Garden*. New York: Rizzoli.
- Steinberg, P.E. 1999. Navigating to multiple horizons: Towards a geography of ocean space. *Professional Geographer*, 51 (3), 366-75.

## BIOS

Nancy Vance is a recently appointed lecturer in the School of Landscape Architecture at Lincoln University, New Zealand. With 14 years-experience as a consulting landscape architect, and as many years sailing the shores of Banks Peninsula, her research focuses on re-conceptualizing the sea/land edge: the natural and cultural layers, the built interventions, their form and materials.

Dr Jacky Bowring is Professor of Landscape Architecture at Lincoln University. Jacky's research and teaching interests circle areas of cultural landscape, history, memory and emotion, and she works through the processes of designing, critiquing and scholarly research. She is editor of the international peer reviewed journal *Landscape Review*, and author of *A Field Guide to Melancholy* (2008, Oldcastle). Recent publications also reflect the response to Christchurch's earthquakes, particularly in the areas of 'design as caring,' dwelling, memory and melancholy.

Dr Mick Abbott is Associate Professor and Head of Lincoln University's School of Landscape Architecture. His research within the university's DesignLab investigates how social, cultural and economic value can be built out of strategies that increase biodiversity. Current design-directed research projects include the Eden Project NZ, Ngai Tahu Farming's 7600ha Eyrewell dairy development project, and Rio Tinto's Paparoa National Park mining restoration project. Edited books on landscape themes include *Wild Heart* (2011), *Making our place* (2011), and *Beyond the Scene* (2010).



COUNCIL OF EDUCATORS  
IN LANDSCAPE ARCHITECTURE

*A CELA Conference Presentation*

*Abstract ID: 128*

## THE EFFECTS OF PARTICIPATION OF COMMUNITY GARDENING ON THE DEVELOPMENT OF SENSE OF COMMUNITY

**KIM, KYUNGHEE**

Ph.D. student, Virginia Tech Institute and State University, Architecture and Urban Studies

**KWON, YOONKU**

Visiting Scholar, Virginia Tech Institute and State University, Architecture and Urban Studies

**KIM, MINTAI**

Associate Professor, Virginia Tech Institute and State University, Architecture and Urban Studies

**BOHANNON, C.L.**

Assistant Professor, Virginia Tech Institute and State University, Architecture and Urban Studies

### 1 ABSTRACT

*This paper aims to examine the effects of participation in community gardening on local Sense of Community (SOC) which refers to "a feeling that members have of belonging, a feeling that members matter to one another and to the group, and a shared faith that members' needs will be met through their commitment to be together (McMilan & Chavis, 1986)." Therefore, SOC emphasizes citizen's psychological bond with their communities so as to maintain and conserve the society.*

*Community gardens play a significant role not only in addressing food issues but more importantly in facilitating social connections among community members.*

*In order to investigate how the participation in community gardening affects the local scale of SOC, the 'Local Sense of Community Index' (LSCI) was developed through reviewing the existing research related to the Sense of Community Index since most existing research focused on urban areas. The authors hope that the Sense of Community index representing a combined feeling of belonging, concern for others, and shared faith among members can be a standard of how we measure the roles of community gardens in forming community vitality.*

*The hypotheses of this study are as follows. First, the participation in community gardening will have a meaningful influence on creating local sense of community. Second, the local SOC will represent differences according to the various categories of the participation, which include the types, level, patterns, and duration of the participation. To verify the hypotheses, the survey on both thirty-four participants who cultivate the products at Hale Y community garden in Blacksburg, VA operated by the YMCA and thirty-one non-participants of community gardening, who are randomly selected in Blacksburg community, will be conducted and analyzed by t-test, f-test and multiple regression analysis.*

*This study has significance in proving the benefit of community gardening for the local sense of community quantitatively which was rarely done in previous studies. Based on the results of this study, we will be able to verify the effectiveness of community gardens as a means of community vitality. In addition,*

---

The authors are solely responsible for the content of this technical presentation. The technical presentation does not necessarily reflect the official position of the Council of Educators in Landscape Architecture (CELA), and its printing and distribution does not constitute an endorsement of views which may be expressed. Technical presentations are not subject to the formal peer review process by CELA Track Chair System; therefore, they are not to be presented as peer-reviewed publications. Citation of this work should state that it is from a CELA conference paper. EXAMPLE: Author's Last Name, Initials. 2014. Title of Presentation. CELA Paper No. 14-xxxx. Baltimore, Maryland: CELA. For information about securing permission to reprint or reproduce a technical presentation, please contact CELA at [dsolco@uta.edu](mailto:dsolco@uta.edu) or 817-272-2321.

*this paper establishes the needs, and suggests implications, of establishing policies of community garden to facilitate village communities.*

## **2.1 Keywords**

Community Garden, Sense of Community, Sense of Community Index, Participation, Hale Y community garden

## **1 INTRODUCTION**

Community gardens have a wide range of meanings according to objectives, governance, and functions all around world. Despite broad definitions, the common concept is to provide a shared physical space for people to do gardening. As many researches showed, community gardening is known to achieve multiple and integrated social, personal, and environmental benefits. Hou et al (2009) summed up the role of community gardens clearly; “connection to nature, physical exercise, health and nutrition, self-esteem, environmental education, personal growth, companionship, skill development, cultural expression, income generation, empowerment” (Hou et al, 2009, 23). Owing to these various benefits, many cities across the world have been developing community gardens, thus expanding its influences. There have been many studies about the effects of community gardening in terms of physical, psychological, social, and environmental benefits.

Even though previous scholars said that community gardens are more about the “community” than they are about “gardening” because it involves interaction between gardeners inevitably (Kurtz, 2001; Glover, 2004; Glover et al, 2005; Krasny et al, 2009), there have been rarely studies to prove how much community gardening engagement help to improve community vitality quantitatively. Thus, this study aims to demonstrate the effects of community gardening on the development of sense of community (SOC) according to the level, patterns, and period of participation using quantitative analysis. It will figure out the determinants to enhance SOC. This research can contribute to encourage communities to take part in gardening in order to vitalize them.

## **2 SENSE OF COMMUNITY**

Sense of community, often referred to as psychological sense of community, has been predominantly associated with the McMillan and Chavis (1986) model, although other conceptual frameworks and several measurements have also been proposed.

As demonstrated by McMillan and Chavis (1986), sense of community refers to “a feeling that members have of belonging, a feeling that members matter to one another and to the group, and a shared faith that members’ needs will be met through their commitment to be together” (p. 9). The following four components are essential to the definition of sense of community: (a) membership, feelings of emotional security, belonging, and identification; (b) influence, by which the community influences the individual and the individual influences the community, in turn; (c) integration and fulfillment of needs, physical and psychological needs met, thereby reinforcing one’s commitment to the group; and (d) shared emotional connection, positive affect and shared history related to community membership (McMillan & Chavis, 1986). Measurement of sense of community has been studied over a wide range of group of peoples. Buckner (1988) developed an instrument to measure neighborhood cohesion. These items are classified into three scales, which are attraction-to-neighborhood, degree of neighboring, and psychological sense of community. Nasar and Julian (1995) also focused on sense of community in neighborhood setting. Given that the urban problems were resulted from a lack of sense of community, they tried to develop reliable and valid measurement in order to assess the sense of community and help establishing policies. Meanwhile, Davidson (1986) examined the sense of community within the city where psychological cohesion is less than neighborhoods or local communities. A 17-item scale was produced for evaluation of homogeneity and external validity in three studies. Long and Perkins (2007) studied sense of community as community social and place predictors. They pointed out that the roles of place and place attitudes have not gotten much



attention. The sense of community index was classified into two level; (a) block level including collective efficacy, participation, neighboring, and place attachment and (b) individual level composed of length of residence, informal social control, participation, and block satisfaction and confidence etc.

Since most of previous studies dealt with urban community or neighborhood settings, for our research Sense of Community Index (SCI) for community gardening was developed through literature reviews and survey of expert group in landscape architecture and community design. The survey result was conducted factor analysis in order to categorize the index according to the characteristics (Table 1).

**Table 1 Sense of community index**

<b>Factors</b>	<b>Index</b>
<b>Reinforcement of needs</b>	1. This community has been successful in getting the needs of its members met.
	2. When I have a problem, I can talk about it with members of this community.
	3. People here know they can get help from others in the neighborhood if they are in trouble.
<b>Membership</b>	1. I feel connected to this community.
	2. I can recognize most of the members of this community.
	3. I put a lot of time and effort into being part of this community.
	4. I feel like I belong here.
<b>Influence</b>	1. This community can influence other communities.
	2. If there is a problem in this community, members can get it solved.
	3. If there is a problem in this community, members can get it solved.
<b>Shared Emotional Connection</b>	1. It is very important to me to be a part of this community.
	2. I am with other community members a lot and enjoy being with them.
	3. Members of this community care about each other.
	4. Members of this community have shared various activities together, such as holidays, celebrations, or disasters.
	5. I feel hopeful about the future of this community.

### 3 METHODS

The hypothesis of this study is as follows. (1) The participation of community gardening will have a meaningful effect on SOC. (2) SOC will be different according to the level, patterns, and period of participation.

#### 3.1 Site & Participants

The target population of this study was identified as participants of community gardening. As a control group, we conducted survey of thirty-two people who haven't participated in community gardening. The site is Hale Y community garden in Blacksburg founded in 1873, which has been run by the YMCA at Virginia Tech. This community gardening program aims to accomplish community development engaging Virginia Tech student, make community members and local organizations dedicated to a community, as well as improve healthy ecological environment and educational opportunities. In order to facilitate community engagement, it is providing several programs, which are garden classes, neighborhood harvest programs, and regular potlucks. Currently, it offers 72 plots for gardeners. Except for the private plots, it has communal spaces for demonstration and voluntary works. But in this study, I only focused on regular gardeners, not temporary volunteers.

#### 3.2 Research Method

The survey of participants and non-participants of community gardening was conducted to figure out the difference according to the participation as well as its type, level, and period. We have done frequency analysis to look into general characteristics of test subject population. Conducting reliability analysis on each questionnaire item, we address predictability and accuracy. For the purpose of examining the difference of SOC depending on participation and its type, level, and period, we conduct T-test and F-test. We conduct correlation analysis to figure out the relation between variables, and multiple regression analysis to measure how the independent variables predict and address the dependent variables.

#### 3.3 Questionnaire and Subjects

Thirty-five subjects from Hale Y community garden and thirty-three subjects of non-participants in community gardening were randomly selected for the questionnaire. Independent variables include four factors, which are demographic, socioeconomic, residential, and community factors (Table 2). The dependent variables are the degree of SOC, which contains reinforcement of needs, membership, influence, and shared emotional connection. 5-point Likert scale was used to measure the degree of SOC. The survey was conducted during the second half of 2015.

**Table 2 Independent Variables**

<b>Demographic factors</b>	Gender, Age, marital status, number of children, age of children
<b>Socioeconomic factors</b>	Educational, income standard
<b>Residential factors</b>	Residence period, area, home ownership, housing type
<b>Community factors</b>	Satisfaction of community, facilities and services

Among the independent variables, meaningful information is as follows.

**Table 3 Demographic analysis of subjects**

<b>Division</b>		<b>Participants Frequency (%)</b>	<b>Non-participants Frequency (%)</b>
<b>Gender</b>	Male	8 (22.9)	11 (33.3)
	Female	27 (77.1)	22 (66.7)
<b>Age</b>	20s	4 (11.4)	2 (6.1)
	30s	5 (14.3)	4 (12.1)
	40s	13 (37.1)	12 (36.4)
	50s	10 (28.6)	14 (42.4)
	Over 60s	3 (8.6)	1 (3.0)
<b>Marital Status</b>	Single	10 (28.6)	5 (14.2)
	Married	25 (71.4)	28 (84.8)
<b>Educational Background</b>	Under High school	13 (27.1)	12 (36.4)
	Over College	22 (62.9)	21 (63.6)
<b>Residential Period</b>	Under 5 years	13 (37.1)	9 (27.3)
	5 – 10 years	10 (28.6)	15 (45.5)
	10 – 20 years	8 (22.9)	6 (18.2)
	Over 20 years	4 (11.4)	3 (9.1)

**Table 4 Characteristics of community gardeners**

<b>Division</b>		<b>Frequency (%)</b>
<b>Type of Role</b>	Gardener	13 (39.4)
	Volunteer	18 (54.5)
	Manager	2 (6.1)
<b>Participation Period</b>	Occasionally whenever I get a free time	6 (17.1)
	Consistently under 6 months	9 (25.7)
	Consistently 6 months – 1 year	11 (31.4)
	Consistently 1 year – 2 year	6 (17.1)
	Consistently 2 year	3 (8.6)
<b>Participation Level</b>	Very Passively	1 (2.86)
	Passively	2 (5.71)
	Normally	6 (17.14)
	Actively	18 (51.43)
	Very Actively	8 (22.86)

#### 4 RESULTS

Overall, the degree of SOC was significantly different depending on the participation of community gardening. To compare Participants' and Non-participants' sense of community, according to the participation decision of the Community Garden, t-test was conducted. As a result, in case of participants' average (3.36) were more than non-participants' (2.94). And then, the results were shown a meaningful difference between them ( $p < .001$ ). Also, all of the factors of Sense of community were shown same results (Table 5). Meanwhile, the results of sense of community according to the demographical factors, a group of aged people felt the Sense of community more and more. And married people's sense of community was more than single. In case of educational background, a group of high educated people's sense of community was more than a group of comparison target. In the case of educational was also shown a meaningful difference between them ( $p < .01$ ) (Table 6). Lastly, t-test and F-test were conducted to examine the difference of sense of community according to 'Type of Role', 'Participation Period', and 'Participation Initiative'. All of the factors were shown a meaningful difference between them ( $p < .05$ ) (Table 7).

**Table 5 SOC according to the participation decision of community gardening**

<b>Division</b>	<b>Participation</b>	<b>N</b>	<b>Av e.</b>	<b>SD .</b>	<b>t</b>	<b>p</b>
<b>SOC</b>	Participant	35	3.6 0	.59 63	5.7 20	.00 0
	Non-Participant	33	3.1 2	.55 79		
<b>Reinforcement of Needs</b>	Participant	35	3.3 6	.67 24	4.4 50	.00 0
	Non-Participant	33	2.9 4	.67 95		
<b>Membership</b>	Participant	35	3.9 5	.67 71	3.1 83	.00 0
	Non-Participant	33	3.6 2	.76 97		
<b>Influence</b>	Participant	35	3.4 8	.64 72	6.4 05	.00 0
	Non-Participant	33	2.9 0	.58 48		
<b>Membership</b>	Participant	35	3.6 1	.76 74	6.0 11	.00 0
	Non-Participant	33	2.9 0	.65 11		

\*p<.1, \*\*p<.05, \*\*\*p<.01

**Table 6 The characteristic of demographical and SOC**

<b>Division</b>		<b>Ave.</b>	<b>SD.</b>
<b>Gender</b>	Male	3.32	.63
	Female	3.27	.62
<b>t (p)</b>		.131	.679
<b>Age</b>	20s	3.06	.53
	30s	3.29	.54
	40s	3.38	.67
	50s	3.47	.64
	Over 60s	3.79	.52
<b>t (p)</b>		1.494	.180
<b>Marital Status</b>	Single	3.25	.59
	Married	3.45	.63
<b>t (p)</b>		2.546	.089
<b>Educational Background</b>	Under High school	3.30	.70
	Over College	3.48	.54
<b>t (p)</b>		4.721***	.029

\*p&lt;.1, \*\*p&lt;.05, \*\*\*p&lt;.01

**Table 7 SOC of participants of community gardening**

<b>Division</b>		<b>Ave.</b>	<b>SD.</b>
<b>Type of Role</b>	Gardener + Volunteer	3.31	.63
	Manager	4.00	.57
<b>t (p)</b>		5.549***	.000
<b>Participation Period</b>	Occasionally whenever I get a free time	3.27	.60
	Consistently under 6 months	3.36	.64
	Consistently 6 months – 1 year	3.87	.60
	Consistently 1 year – 2 year	3.99	.54
	Consistently 2 year	3.76	.52
<b>t (p)</b>		6.678**	.001
<b>Participation level</b>	Very Passively	3.01	.59
	Passively	3.19	.58
	Normally	3.56	.43
	Actively	3.83	.62
	Very Actively	3.88	.46
<b>t (p)</b>		8.320**	.000

\*p<.1, \*\*p<.05, \*\*\*p<.01

#### **4.1 Reliability Analysis of the Sense of Community Index**

To examine about the stability, consistency and predictability of the sense of community index, reliability analysis was conducted. In this study, Cronbach's alpha was utilized to examine the index. Most of researcher in the field of social science said that if the Cronbach's alpha over 0.6, it would not have a problem of reliability of index. According to the results, all of the index's Cronbach's alpha were shown over 0.7. So, the index was satisfied with the reliability (Table 8).

**Table 8 Reliability analysis of the SOC index**

<b>Component</b>	<b>Question</b>	<b>Ave.</b>	<b>Cronbach's Alpha</b>
<b>Reinforcement of Needs</b>	3	3.249	.867
<b>Membership</b>	4	3.875	.746
<b>Influence</b>	3	3.334	.763
<b>Shared Emotional Connection</b>	5	3.447	.789
<b>SOC</b>	15	3.436	.948

## **4.2 Correlation analysis**

### **4.2.1 Correlation between the Independent Variables**

To examine the correlation between the Independent Variables, a Pearson Correlation Analysis was conducted. If the correlation coefficient is over 0.6, it is considered a multicollinearity. According to the results, Marital Status and Age have a high correlation. However, they don't seem like have a problem about the multicollinearity. And also, the difference of the participation that is considered important in this study and other variables' correlation was low.



**Table 9 Correlation between the independent variables**

Division	Participation	Gender	Age	Marital Status	Education	Income	Residence period	Local problem	Local satisfaction
Participation	1								
Gender	.143	1							
Age	-.034	.094	1						
Marital Status	.044	.259**	.734**	1					
Education	.039	-.148	-.345**	-.303**	1				
Income	.081	.133	-.150	-.003	.199**	1			
Residence period	-.074	.059	.274**	.234**	-.235**	-.101	1		
Local problem	-.072	-.077	-.078	-.178*	.094	-.052	.071	1	
Local satisfaction	.096	-.001	.017	-.039	.003	-.051	.034	.061	1

\*p>.05, \*\*p<.01

#### 4.2.2 Correlation between the Independent and dependent variables

(1) Correlation Analysis between Participation, character of demographical Variables and SOC  
Type of participation, participation period, participation initiative, age and educational background were shown a meaningful correlation with the dependent variables, SOC.

**Table 10 Correlation analysis between participation, demographical variables and SOC**

Division	Types	Period	level	Gender	Age	Marital Status	Education	Income	SOC
Types	1								
Period	-.332**	1							
level	-.074**	.303**	1						
Gender	-.030	-.015	-.126	1					
Age	-.239*	.124	.211*	.091	1				
Marital Status	-.222*	.102	.067	.234**	.711**	1			
Education	-.090	.056	.061	-.126	-.323**	-.311**	1		
Income	-.121	.211*	.044	.101	-.122	-.004	.113**	1	
SOC	-.345**	.383**	.482**	.022	.183**	.113	.121*	.102	1

\*p>.05, \*\*p<.01

(2) Correlation Analysis between Characteristics of Residence, Local society attitude and SOC  
Local Problem and Local Satisfaction were shown a meaningful correlation with the dependent variables, SOC.

**Table 11 Correlation analysis between characteristics of residence, local society attitude and SOC**

Division	Residential Period	Local Problem	Local Satisfaction	SOC
Residential Period	1			
Local Problem	.081	1		
Local Satisfaction	.072	.052	1	
SOC	-.014	-.160**	.262**	1

\*p>.05, \*\*p<.01

#### 4.2.3 Analysis with participation decision of Community Garden and SOC

##### 1) Simple regression analysis

Participation is shown a meaningful effect with all of other dependent variables.

Table 12 Simple regression analysis

Dependent Variable	Independent Variable	Unstandardization Coefficients		Standardization Coefficients	t	p	Model Summary
		B	SE	Beta			
SOC	(Constant)	2.897	.059	-	41.938	.000	R=.315, R <sup>2</sup> =.151, Adj. R <sup>2</sup> =.146
	Participant	.481	.81	.384	4.728	.000	SE=.49286, F-value=31.677***
Reinforcement of Needs	(Constant)	2.722	.069	-	49.105	.000	R=.389, R <sup>2</sup> =.095, Adj. R <sup>2</sup> =.092
	Participant	.412	.84	.282	4.348	.000	SE=.62831, F-value=13.657***
Membership	(Constant)	3.213	.065	-	42.215	.000	R=.136, R <sup>2</sup> =.045, Adj. R <sup>2</sup> =.041
	Participant	.324	.111	.227	2.271	.000	SE=.62574, F-value=12.134***
Influence	(Constant)	2.751	.057	-	41.852	.000	R=.441, R <sup>2</sup> =.290, Adj. R <sup>2</sup> =.253
	Participant	.571	.089	.421	5.321	.000	SE=.51729, F-value=32.214***
Shared Emotional Connection	(Constant)	2.728	.064	-	37.203	.000	R=.432, R <sup>2</sup> =.167, Adj. R <sup>2</sup> =.155
	Participant	.614	.111	.393	5.089	.000	SE=.53672, F-value=21.152***

## 2) Multiple regression analysis

### (1) The effect of Participation Decision of Community garden on SOC

In case of participation of Community Garden was evaluated the SOC higher than the group of non-participation (B=.479). Educational Background and Residence Character, Ownership of Residence, Local Problem and Local Satisfaction were shown a meaningful effect on the SOC. According to the result of regression analysis, independent variables were explained the dependent variables in 37% (R<sup>2</sup>=.371). And the result was had a meaning in  $p < .01$ . So, this model could somewhat explain the effect of Participation Decision of Community garden on SOC. And also, there were no values under 0.1 in the tolerance values and over 10 in the VIF values. So, it means that the results had nothing to have with multicollinearity.

**Table 13 The effect of participation decision of community gardening on SOC**

Dependent Variable	Unstandardization Coefficients		Standardization Coefficients	t	p	Collinearity Statistics	
	B	SE	Beta			Tolerance	VIF
<b>Participation</b>	.479	.070	.342	5.635	.000***	.860	1.121
<b>Educational background</b>	.277	.077	.184	1.754	.000***	.751	1.229
<b>Residential period: Recently</b>	.185	.084	.124	1.465	.057*	.725	1.218
<b>Ownership of residence: Etc.</b>	-.366	.217	-.129	-1.357	.081*	.710	1.312
<b>Local Problem</b>	-.075	.030	-.140	-2.317	.029**	.791	1.222
<b>Local Satisfaction</b>	.214	.035	.229	4.168	.000***	.857	1.468

\*p<.1, \*\*p<.05, \*\*\*p<.01

(2) The effect of Participation Decision of Community garden on Reinforcement of Needs  
 In case of participation of Community Garden was evaluated the Reinforcement of Needs higher than the group of non-participation (B=.342).

**Table 14 The effect of participation decision of community gardening on Reinforcement of Needs**

Dependent Variable	Unstandardization Coefficients		Standardization Coefficients	t	p	Collinearity Statistics	
	B	SE	Beta			Tolerance	VIF
<b>Participation</b>	.342	.082	-.036	4.188	.000***	.704	1.768
<b>Age</b>	.141	.062	.123	2.325	.029**	.603	3.304
<b>Educational background</b>	.347	.152	.043	3.126	.001***	.560	1.336
<b>Local Satisfaction</b>	.273	.062		5.054	.000***	.761	1.162

\*p<.1, \*\*p<.05, \*\*\*p<.01

(3) The effect of Participation Decision of Community garden on Membership  
 In case of participation of Community Garden was evaluated the membership higher than the group of non-participation (B=.312). If the local problem is considered not serious, it has a meaningful effect on the Membership (B=-.112).

**Table 15 The effect of participation decision of community gardening on Membership**

Dependent Variable	Unstandardization Coefficients		Standardization Coefficients	t	p	Collinearity Statistics	
	B	SE	Beta			Tolerance	VIF
<b>Participation</b>	.312	.111	.203	3.072	.001***	.704	1.124
<b>Age</b>	.109	.028	.313	2.683	.003***	.333	2.803
<b>Educational background</b>	.150	.166	.133	1.711	.082*	.570	1.513
<b>Local Problem</b>	-.112	0.41	-.167	-2.154	.031**	.798	1.213
<b>Local Satisfaction</b>	.092	.52	.121	1.727	.082*	.761	1.362

\*p<.1, \*\*p<.05, \*\*\*p<.01

(4) The effect of Participation Decision of Community garden on Influence

In case of participation of Community Garden was evaluated the Influence higher than the group of non-participation (B=.533). If the local problem is considered not serious, it has a meaningful effect on the Meaning (B=-.138). The odd thing is, group of moving recently has a meaningful effect on the influence (B=.225).

**Table 16 The effect of participation decision of community gardening on Influence**

Dependent Variable	Unstandardization Coefficients		Standardization Coefficients	t	p	Collinearity Statistics	
	B	SE	Beta			Tolerance	VIF
<b>Participation</b>	.533	.069	.231	4.322	.000***	.800	1.131
<b>Educational background</b>	.236	.086	.338	1.357	.013**	.740	1.295
<b>Residential period: Recently</b>	.225	.126	.126	1.504	.016**	.795	1.264
<b>Local Problem</b>	-.153	.034	-.096	-2.312	.000***	.791	1.141
<b>Local Satisfaction</b>	.136	.040	.121	4.396	.001***	.656	1.513

\*p<.1, \*\*p<.05, \*\*\*p<.01

(5) The effect of Participation Decision of Community garden on Shared Emotional Connection

In case of participation of Community Garden was evaluated the Shared Emotional Connection higher than the group of non-participation (B=.538).

Table 17 The effect of participation decision of community gardening on Reinforcement of Shared Emotional Connection

Dependent Variable	Unstandardization Coefficients		Standardization Coefficients	t	p	Collinearity Statistics	
	B	SE	Beta			Tolerance	VIF
<b>Participation</b>	.538	.110	.375	4.268	.000***	.804	1.136
<b>Age</b>	.131	.057	.181	2.223	.027*	.363	3.364
<b>Educational background</b>	.314	.120	.182	2.137	.003***	.780	1.376
<b>Ownership of residence: Etc.</b>	-.450	.226	-.124	-1.123	.056*	.763	1.348
<b>Local Problem</b>	-.112	.010	-.219	-1.227	.024**	.858	1.174
<b>Local Satisfaction</b>	.115	.027	.145	2.847	.000***	.841	1.131

\*p<.1, \*\*p<.05, \*\*\*p<.01

#### 4.2.4 Analysis with participation of Community Garden and SOC

##### 1) Simple regression analysis

Participation Initiative and Participation Period were had a meaningful effect on the SOC and its subcategories. While the participation type were had not a meaningful effect on all of dependent variables.

Table 18 Simple regression analysis of the participation of community gardening and SOC

Dependent Variable	Independent Variable	Unstandardization Coefficients		Standardization Coefficients	t	p	Model Summary
		B	SE	Beta			
SOC	(Constant)	2.938	.214	-	12.638	.000	R=.453, R <sup>2</sup> =.208, Adj-R <sup>2</sup> =.181 Std. Error of Estimate=.40740 F-Value=11.042***
	Participation type	-.097	.135	-.062	-.545	.347	
	Participation level	.238	.054	.370	2.169	.001**	
	Participation period	.470	.113	.342	4.390	.001**	
Reinforcement of Needs	(Constant)	2.863	.276	-	6.214	.000	R=.327, R <sup>2</sup> =.091, Adj-R <sup>2</sup> =.051 Std. Error of Estimate=.52271 F-Value=5.110***
	Participation type	-.098	.165	-.063	-.533	.365	
	Participation level	.175	.066	.227	1.851	.031**	
	Participation period	.321	.138	.217	1.887	.020**	
Membership	(Constant)	3.435	.275	-	10.141	.000	R=.339, R <sup>2</sup> =.082, Adj-R <sup>2</sup> =.224 Std. Error of Estimate=.43312 F-Value=13.421***
	Participation type	-.092	.164	-.066	-.571	.387	
	Participation level	.171	.066	.257	1.328	.005**	
	Participation period	.382	.138	.272	1.586	.003** *	
Influence	(Constant)	2.608	.235	-	8.613	.000	R=.488, R <sup>2</sup> =.248, Adj-R <sup>2</sup> =.181 Std. Error of Estimate=.40722 F-Value=11.021***
	Participation type	-.031	.141	-.015	-.172	.565	
	Participation level	.271	.057	.387	4.013	.000** *	
	Participation period	.535	.118	.417	2.542	.000** *	
Shared Emotional Connection	(Constant)	2.847	.303	-	7.321	.000	R=.402, R <sup>2</sup> =.169, Adj-R <sup>2</sup> =.187 Std. Error of Estimate=.58125 F-Value=7.783***
	Participation type	-.111	.180	-.051	-.618	.362	
	Participation level	.320	.073	.411	2.912	.001** *	
	Participation period	.433	.151	.331	1.129	.017**	

## 2) Multiple regression analysis

## (1) The effect of participation of Community Garden on SOC

The participation initiative was only had a meaningful effect on the SOC (B=.160). This result means that the more initiative participate, the more evaluated the SOC.

## (2) The effect of Participation of Community garden on Reinforcement of Needs

## (3) The effect on participation of Community garden on Membership

In case of more Participation Initiative and participation period were evaluated the Membership higher.

## (4) The effect of participation of community garden on Influence



In case of more Participation Initiative and participation period were evaluated the Influence higher.  
 (5) The effect of participation of community garden on Shared Emotional Connection  
 In case of more Participation Initiative was evaluated the Shared Emotional Connection higher.

**Table 19** The effect of participation of community gardening on SOC

Dependent Variable	B	SE	Beta	t	p	Collinearity Statistics	
						Tolerance	VIF
<b>Participation level</b>	.160	.032	.369	5.348	.002***	.513	1.443
<b>Ownership of residence: Etc.</b>	- .602	.221	-.231	-1.431	.012*	.536	1.502
<b>Local Problem</b>	- .221	.065	-.225	-1.353	.105**	.217	1.994

\*p<.1, \*\*p<.05, \*\*\*p<.01

## 5 DISCUSSION & CONCLUSION

This paper pays attention to the quantitative value of participation of community gardening in developing sense of community, which represents reinforcement of needs, necessity of membership, influence, and shared emotional connection. Overall, the degree of SOC was significantly different depending on the participation of community gardening. The result of the t-test which compared of SOC degree between participants and non-participants showed that SOC score of participants group was higher, which was statistically significant. In addition, multiple regression analysis was conducted in order to examine the SOC degree depending on the participation of gardening. Our result showed that whether taking part in community gardening had a statistically meaningful effect on dependent variables which were SOC including Reinforcement of Needs, Membership, Influence, and Shared Emotional Connection. More specifically in order to investigate the SOC according to type of roles, level, and duration of the participation of the community gardening, we conducted t-test and f-test by which the results showed the significantly difference in every category. In addition, the multiple regression analysis of the relationship between SOC and the participation, both of which were dependent variables, showed that the variable of activeness of participation, defined as 'participation level' was only deemed statistically significant.

With regard to the effect of the participation on "Reinforcement of Needs", there was no meaningful variable among the independent variables of participation while independent variables of participation level and period were statistically significant in both "Membership" and "Influence". The 'participation type' did not meaningful influence on SOC components, which would come up with because the number of manager was comparatively smaller than gardeners or volunteers. Briefly, the SOC degree of the group of community gardening participants was higher than the other group. The study concluded that the more active and longer they participate, the higher the SOC.

This study has some limitations in terms of sample size, target area. Considering each groups' sample size was around thirty and it targeted only Blacksburg area, it is necessary to expand the range of subjects and area in order to generalize the results. Another expected problem is that this study did not exactly figure out whether subjects rated the SOC considering the whole Blacksburg area or within the gardeners. Thus, further research about additional quantitative analysis with in-depth interviews is necessary. Furthermore, since the fact that the SOC of gardeners was higher could be caused by that people having high degree of the SOC would take part in gardening actively, it is necessary to trace a causal link conversely. Nevertheless, this study has significance as it confirmed empirically the objectives of community gardens as a way of community vitality. While previous researches have been dealing with the development of community through community involvement, this study focused on more the specific activity of community gardening. Through the result of this research, community garden can be suggested as a means of prevention of disintegration of community. In this respect, a supporting policy regarding community gardens should be expanded for community revitalization.

## 6 REFERENCES

- Buckner, J. C. (1988). The development of an instrument to measure neighborhood cohesion. *American Journal of Community Psychology*, 16(6), 771-791.
- Chavis, D. M., Hogge, J. H., McMillan, D. W., & Wandersman, A. (1986). Sense of community through Brunswik's lens: A first look. *Journal of community psychology*, 14(1), 24-40.
- Chavis, D.M. et al.(2008) The sense of community(SCI) Revised: The reliability and Validity of the SCI-2. Paper presented at the 2nd International Community Psychology Conference, Lisbon, Portugal.
- Davidson, W.B. and Patrick R. Cotter(1986) Measurement of sense of community within the sphere of city, *Journal of applied social psychology*, 16(7): 608-619
- Fisher, T. L., & Sparenborg, K. (2011). *Lost communities of Virginia*. Earlysville, VA: Albemarle Books.
- Fuguitt, G. V., Brown, D. L., & Beale, C. L. (1989). *Rural and small town America*. Russell Sage Foundation.
- Glover, T. D. (2004). Social capital in the lived experiences of community gardeners. *Leisure Sciences*, 26(2), 143-162.
- Howell, D. (2012). *Statistical methods for psychology*. Cengage Learning.
- Kingston, S., Mitchell, R., Florin, P., & Stevenson, J. (1999). Sense of community in neighborhoods as a multi-level construct. *Journal of Community Psychology*, 27(6), 681-694.
- Lobao, L. M. (1990). *Locality and inequality: Farm and industry structure and socioeconomic conditions*. SUNY Press.
- Long, D. Adam and Douglas D. Perkins(2007) Community social and place predictors of sense of community: A multilevel and longitudinal analysis, *Journal of community psychology*, 35(5): 563-581
- Mattson, G. A. (1997). Redefining the American small town: community governance. *Journal of Rural Studies*, 13(1), 121-130.
- McMillan, D. W., & Chavis, D. M. (1986). Sense of community: A definition and theory. *Journal of community psychology*, 14(1), 6-23.
- Nasar, Jack L. and David A. Julian(1995) The psychological sense of community in the neighborhood, *Journal of the American planning association*, 61(2): 178-184
- Obst, P.L., & White, K.M. (2004). Revisiting the sense of community index: A confirmatory factor analysis. *Journal of Community Psychology*, 32, 691-705.

- Peterson, N. Andrew, et al.(2008) Validation of a brief sense of community scale: Conformation of the principal theory of sense of community, *Journal of community psychology*, 36(1): 61-73
- Tartaglia, Stefano(2006) A preliminary study for a new model of sense of community, *Journal of community psychology*, 34(1): 25-36



COUNCIL OF EDUCATORS  
IN LANDSCAPE ARCHITECTURE

*A CELA Conference Presentation*

**Abstract ID: 131**

## **CYCLING-FRIENDLY COMMUNITY DESIGNS: COMPARATIVE CASE STUDIES OF CITIES IN GERMANY AND TEXAS, USA**

### **ZHONG, SINAN**

Ph.D. student of Urban and Regional Science, Department of Landscape Architecture and Urban Planning, Texas A&M University

### **LEE, CHANAM**

Professor of Landscape Architecture & Urban Planning, Texas A&M University

### **ABSTRACT**

*Cycling has been increasingly recognized for its various environmental, human health, and economic benefits. Supportive built environments and policies are essential to promote cycling. European countries, such as Germany, Denmark, and the Netherlands, are known for their many exemplary efforts. Cycling levels in these countries are at least 10 times higher than those in the US. While empirical studies have examined various cycling policies and interventions, most of them are individual case studies. Studies comparing the differences between European cities and American cities are limited.*

*This study is designed to compare cycling-friendly environments between two German cities and one American city in Texas, all of which has a major university. The comparison focused on three components, including (a) policies, (b) community designs, and (c) infrastructure/facilities. Lessons from German examples are summarized as guidelines, strategies, and implications for improving cycling environments in Texas. This study used two German cities (Berlin and Bonn) and one American city in Texas (Austin) for comparison, and identified opportunities and challenges in improving cycling environments in Austin. This two-phased study first evaluated the three study components according to the six dimensions of urban design including functional, morphological, perceptual, social, visual, and temporal dimensions. The second phase involved a more detailed examination of a 1,200m by 1,200m area covering part of a university campus and the surroundings in each of the three cities. Assessments of multiple evaluation components showed that cycling was much safer and more convenient in German cities than in Austin, due to more supportive bicycle policies and infrastructure/facilities. Both national and city-level bicycle policies existed in German cities, and those policies were geared toward integrating cycling into the overall transportation system, including transit. Austin, on the other hand, only had the city-level policies, and most of its streets are still dominated by automobiles. In terms of the community design, German cities feature mixed land use, high density, and complete cycling networks making cycling highly attractive, contrasting to segregated land use, low density, and discontinuous cycling networks in Austin.*

*This study offers insights on policies and design interventions that can contribute to promoting safe and attractive cycling environments, ultimately promoting cycling in Texas.*

### **1.1 Keywords**

Cycling, Healthy Living, Environments, Policies, Community Designs, Infrastructure and Facilities

---

The authors are solely responsible for the content of this technical presentation. The technical presentation does not necessarily reflect the official position of the Council of Educators in Landscape Architecture (CELA), and its printing and distribution does not constitute an endorsement of views which may be expressed. Technical presentations are not subject to the formal peer review process by CELA Track Chair System; therefore, they are not to be presented as peer-reviewed publications. Citation of this work should state that it is from a CELA conference paper. EXAMPLE: Author's Last Name, Initials. 2014. Title of Presentation. CELA Paper No. 14-xxxx. Baltimore, Maryland: CELA. For information about securing permission to reprint or reproduce a technical presentation, please contact CELA at [dsolco@uta.edu](mailto:dsolco@uta.edu) or 817-272-2321.

## 2 INTRODUCTION

During the past few decades, the importance of cycling to environment, human health, and economic development has been increasingly recognized in many European countries and in some parts of the United States (US). At the same time, several scholars have conducted empirical studies examining benefits of cycling and exploring ways to promote cycling-friendly environments. Specifically, John Pucher and Ralph Buehler carried out many studies on the contributions of daily cycling to public health (Bassett, Pucher, Buehler, Thompson, & Crouter, 2008; Pucher & Buehler, 2010; Pucher, Buehler, Bassett, & Dannenberg, 2010), ways to make cycling safe and attractive (Pucher & Buehler, 2008a, 2008b, 2009; Pucher & Dijkstra, 2000, 2003), and sustainable transportation in European countries (Buehler & Pucher, 2009; Buehler & Pucher, 2011). Many European cities, such as Amsterdam, Copenhagen, Hamburg, Munich, Berlin, etc., have paid attention to people-oriented developments to create more sustainable and livable communities. A wide range of strategies such as traffic regulation, traffic education, traffic calming, cycling infrastructure, and cycling oriented urban design have been implemented to increase cycling safety (Pucher & Dijkstra, 2000, 2003). In the US, however, despite growing investments in cycling infrastructure and promotion efforts, especially in large cities such as New York, Washington DC, and Portland, the prevalence of cycling is still very low compared to many European countries. Cycling infrastructure involving bicycle lanes, trails, and bicycle parking facilities are far from being adequate in the US. Compared to 27% share of trips bicycles make up in the Netherlands, only approximately 1% of trips in the US are by bicycle. Germany and Denmark are both at the high end of the spectrum with 10% and 18% of cycling mode share, respectively (Pucher & Buehler, 2008b).

The cycling levels vary across the regions in the US. In Texas, the levels of cycling to work are much lower than the national average with only 0.3% in 2014, resulting in higher dependence on automobiles (McKenzie, 2014; US Census Bureau, 2010-2014). Automobile dependency has been shown to be a major contributor to physical inactivity and sedentary lifestyle, which has been linked with many public health problems such as obesity (Jebb & Moore, 1999; Wen, Orr, Millett, & Rissel, 2006). By 2010,

Texas was one of the 12 states with a prevalence of obesity equal to or greater than 30% in the US (Centers for Disease Control and Prevention, 2011). Lack of physical activity and poor diet lead to obesity which is among the leading causes of death in the US accounting for 400,000 deaths or 16.6% of total death in 2000, immediately following tobacco (18.1%) (Mokdad, Marks, Stroup, & Gerberding, 2004). The estimated annual medical cost of obesity in the US could amount to \$147 billion in 2008, accounting for approximately 10% of all medical spending (Finkelstein, Trogon, Cohen, & Dietz, 2009). In addition to walking, cycling is a convenient way to incorporate healthy physical activity into people's daily routine as an efficient travel mode. Compared to the dramatic increase in efforts to promoting walking, efforts on cycling promotion have been limited and significant gaps remain between research and practice on cycling. Even though many empirical studies have indicated the significance of cycling, most practices of urban design focus more on pedestrians and motorized vehicles, sometimes overlooking the potential conflicts between cyclists and pedestrians or vehicles (Forsyth & Krizek, 2011). Moreover, compared to many studies on cycling safety in European cities and in several large cities in the eastern and western regions of the US, studies on cycling in Texas are scarce. Therefore, more studies are needed on cycling-friendly community designs to promote cycling, which can help counteract the spread of sedentary lifestyles and obesity in Texas and beyond.

## **2.1 Benefits of cycling**

Cycling, as a healthy and sustainable transportation mode, can bring significant environmental, health, and economic benefits. First of all, cycling generates no air or water pollution and little noise, and it does not consume any non-renewable energy resources; secondly, compared to cars and other motorized transport modes, parking spaces needed for bicycles are quite small; and thirdly, cycling is much more economical and affordable than motorized transport modes, making it acceptable for and available to everyone including those with limited economic resources (Pucher & Buehler, 2008b, 2010).

Besides, cycling is an active transportation mode that can bring significant health benefits. Cardiovascular exercise, as a valuable outcome of cycling, can help restore, maintain, and improve both emotional and physical health (Pucher & Buehler, 2008b). Oja et al. (1991) conducted research about

physiological influences of walking and cycling to work, which demonstrated that improved cardiorespiratory and metabolic fitness could be achieved by low-intensity walking and cycling to work at least 3.5 days per week. Huy, Becker, Gomolinsky, Klein, and Thiel (2008) argued that cycling could directly improve older adults' health. Bassett et al. (2008) carried out a study on the effects of walking and cycling on obesity rates in Europe, North America, and Australia, and reported that walking and cycling was negatively associated with obesity. Wen and Rissel (2008) studied relationships between active modes of commuting to work and obesity rates in Australia and revealed "cycling, in particular, had a strong inverse association with being obese" for men (p. 31). Pucher et al. (2010) studied influences of walking and cycling on health, which indicated that self-reported obesity had statistically significantly negative relationships with active travel.

## **2.2 Cycling Trends in Germany and the US**

The cycling level in Germany has not been consistently high. Due to the widespread use of private cars, cycling fell dramatically from 1950 to 1975, resulting in increasingly harmful environmental and safety problems. In the mid-1970s, German cities started to establish transportation and urban planning policies to restrict car use by making it more expensive, slower, and less convenient while encouraging environmentally friendly alternatives to cars. Cycling, as one of the most important alternatives, gradually became a popular means of transportation for people's daily routines. Strategies to promote cycling-friendly environments fostered the recovering and thriving culture of cycling in Germany (Pucher & Buehler, 2008b, 2009).

Over the past few decades, the overall cycling level in the US had increased as well because of the realization of its benefits and of the harms of automobile dependence. In the US, cycling to work grew from 0.4% in 1990 to 0.6% in 2014 (City of Austin, 2009; US Census Bureau, 2010-2014), and the bicycle share of total trips rose from 0.6% in 1977 to 1.0% in 2009 (Pucher, Buehler, & Seinen, 2011). When compared to 10% of the bicycle mode share in Germany (see Table 1), bicycle use in the US is still quite low. Cycling rates are unevenly distributed in the US due to the differences in climate, environmental supports for cycling,

and socioeconomic characteristics. Cycling levels are commonly higher in the western part of the US and areas near city centers, and the elderly and women cycle far less than young men (Pucher et al., 2011). In contrast, cycling in Germany has become a mainstream mode of transportation for both recreational purposes and practical and daily travel needs to get around cities. Cycling is fairly evenly distributed in Germany across groups with various incomes and genders, but the cycling rate declines slightly with the increase of age (Pucher & Buehler, 2008b).

**Table 1 Daily and annual cycling trips in Germany and the US**

	Germany		US	
	2002	2008	2001	2009
Percentage of all trips (%)	8.7	10.0	0.9	1.0
Number of trips per person per day	0.32	0.39	0.03	0.04
Number of trips per person per year	116.8	142.4	11.0	14.2
Minutes per person per day	5.79	6.42	0.75	0.77
Hours per person per year	35.2	39.1	4.5	4.7
Kilometers per person per day	0.94	1.11	0.08	0.11
Kilometers per person per year	343.1	405.2	29.2	40.2

*Note.* Adapted from “Active travel in Germany and the U.S. Contributions of daily walking and cycling to physical activity” by R. Buehler, J. Pucher, D. Merom, & A. Bauman, 2011, *American Journal of Preventive Medicine*, 41(3), p.243

### **2.3 Factors related/contributed to cycling**

Based on the cycling trends during the past decades, significant differences can be observed between the US and Germany. The fact that cycling in the US is a less accessible and attractive transportation mode is primarily attributed to the neglect of cycling safety and cycling supportive facilities. In Germany, a diverse range of policies such as traffic regulations and related programs, community design solutions, and supportive infrastructure and facilities have been implemented to make cycling safer and more popular (Pucher & Buehler, 2008b; Pucher et al., 2011).

German governments have played an essential role in planning policies and interventions to create cycling-friendly environments and to fund cycling infrastructure and facilities. Since at least the 1970s, local governments in Germany have been funding and implementing cycling related policies, programs, and plans that are tailored based on the local contexts and needs. More recently, since approximately the 1980s,



federal/central governments have been providing research supports, design guidelines, model projects and funding for cycling (Pucher & Buehler, 2008b). The German National Cycling Plans were first proposed in 2002 and updated in 2012 to promote cycling safety by specifying relevant goals and strategies/measures, which included restrictions and regulations on the use of motor vehicles and an increased supply of facilities for cycling including cycling lanes, cycling crossings at intersections, and bicycle parking spaces (Federal Ministry of Transport, 2012).

Besides, the role of urban design including overall community designs and detail designs of bicycle supportive infrastructure and facilities is of equal importance. Efficient and comprehensive design solutions can make cycling experiences more pleasant and delightful, as well as safer. Compared to comprehensive, integrated, and coordinated cycling route systems covering in both rural and urban areas in Germany, cycling supportive infrastructure and facilities are far from being sufficient and efficient in the US with incomplete and disconnected systems in most communities (Pucher & Dijkstra, 2000).

### **3 METHODS**

This case study aims to compare cycling-friendly environments between two German cities (Berlin and Bonn) and one American city in Texas (Austin), and it is carried out in two major phases. Lessons from German best practices are summarized as guidelines, strategies, and implications for promoting cycling environments in Texas. The first phase focuses on each of the three target study areas – policies, community designs, and infrastructure/facilities – in greater detail to discuss how they contribute to promoting cycling. In this phase, assessments of each study area were made based on relevant information from the previous studies and policy documents from local and federal governments. Further, casual direct observations from the visits were used to further confirm the actual features implemented in the study communities. To guide the evaluation of the community design component, six dimensions of urban design including functional, morphological, perceptual, social, visual, and temporal dimensions are further explored to take the experience of cycling from the cyclist's viewpoint into the discussion of urban design

requirements/preferences (Forsyth & Krizek, 2011). The second phase contains a more detailed evaluation of community designs and cycling supportive infrastructure and facilities within a 1,200m by 1,200m area covering part of a university campus and the surroundings in each of the three cities. This particular study location was selected to ensure some comparability across the three cities with widely varying environmental characteristics. The presence of a major university was a common feature of all three cities. This size of area was selected to ensure feasibility of the direct field observation and to reflect about a 5-minute cycling distance. The selected areas are located around the main buildings of the major university located in each of the three study cities, including Humboldt University of Berlin and University of Bonn in Germany, and University of Texas at Austin in the US. As shown in Table 2, the three cities have the population size ranging from 3.5 million in Berlin to 0.9 million in Austin, and the population density from 3,891.4 to 1,183.0 persons per square kilometers.

**Table 2 Basic statistics of the German cities and Austin, Texas**

	Berlin	Bonn	Austin
Population in 2014	3,469,849	313,958	912,791
Population density (persons/square kilometers) in 2014	3,891.4	2,225.7	1,183.0
Land area (hectares)	89,168	14,106	77,156
Land area (square kilometers)	891.68	141.06	771.56
Land area (square miles)	344.28	54.46	297.90
Major university and its enrollment	Humboldt University of Berlin	University of Bonn	University of Texas at Austin
Enrollment	34,214 students	32,500 students	50,950 students

*Sources.* City Population (2015a); City Population (2015b); The Humboldt University of Berlin (2016); The University of Bonn (2014); The University of Texas at Austin (2015);

## 4 FINDINGS

### 4.1 Policies

A variety of policies, including both nationwide and citywide policies on a broad range of issues related to land use, transportation, urban development, environment, housing, parking, and taxation, have been implemented in Germany to facilitate safe and convenient cycling. Nationwide or statewide policies

and design guidelines regarding cycling are not available in the US. Therefore, this study discussing cycling policies in the US city is based on the city level, while discussions on the cycling policies in Germany involve both national and city levels.

The city of Austin has the best overall cycling environment and the highest level of cycling to work in Texas with 1.4% in 2014, which is much higher than the national average (City of Austin, 2009; US Census Bureau, 2010-2014). Austin is the leading city in Texas in taking actions to promote sustainable transportation including cycling. Cycling has become increasingly important in people's daily life in Austin. The Austin Bicycle Plans including a series of cycling related policies have been adopted and updated periodically since 1972 to achieve the vision of making Austin one of the best cycling friendly communities in the US. Promoting cycling environments guided by the city's Bicycle Plans makes Austin a valuable example for other cities in Texas to follow. By comparing cycling related policies and design guidelines in Austin with those in German cities, potentials and challenges of promoting cycling in Austin as well as in other Texas communities can be better identified.

Compared to Germany, cycling related policies in Austin are still far from being adequate, especially for those regarding the restrictions of car use. Car use in Germany is much less convenient and far more expensive because of high taxes, high parking prices, limited parking spaces, etc. Table 3 summarizes a list of cycling related policies to compare specific strategies and measures in German cities and Austin, in terms of (a) land use and housing, (b) transportation, (c) parking, (d) taxation, and (e) traffic law.

**Table 3 Cycling related policies in German cities and Austin, Texas**

Categories	Specific strategies	
	German cities	Austin
Land use and housing policies	<ul style="list-style-type: none"> <li>• Limitation of new developments beyond already built-up areas</li> <li>• Mixed use developments to make short distance trips by bicycle or on foot available</li> </ul>	<ul style="list-style-type: none"> <li>• Low density land use (major destinations are not within a 5-minute biking distance)</li> </ul>
Transportation policies	<ul style="list-style-type: none"> <li>• Traffic education and training</li> <li>• Complete street: multi-modal transportation to integrate the bicycle system with transit</li> <li>• Traffic regulations (e.g. restrictions on the use of motor vehicles, limited car access to neighborhoods, etc.)</li> <li>• Speed limitations of motor vehicles (e.g. 30 kilometers/hour [19 miles/hour] or less in residential neighborhoods, 7 kilometers/hour [4 miles/hour] in home zones, etc.) through traffic calming, home zones, car-free zones, deliberately narrowed roadways, etc.</li> <li>• Shared bike bus lane to promote bike use while limit car use</li> <li>• Well maintained and separate circulation systems for cyclists versus motorists</li> <li>• Priority traffic signals and crossing intersection improvements for cyclists</li> </ul>	<ul style="list-style-type: none"> <li>• Traffic education, cycling training, and cycling promotion (e.g. cycling to school, cycling to work, etc.)</li> <li>• Complete street: multi-modal transportation to integrate the bicycle system with transit (underway)</li> <li>• Little restrictions on car use with complete road networks for cars</li> <li>• Speed limitations of motor vehicles (e.g. 48 kilometers/hour [30 miles/hour] or less in residential neighborhoods, 32 kilometers/hour [20 miles/hour] or less in school zone, etc.) through signage, traffic calming, etc.</li> <li>• Incomplete and discontinuous cycling networks (limited bicycle lanes and crossings)</li> </ul>
Parking policies	<ul style="list-style-type: none"> <li>• Limited car parking spaces in cities</li> <li>• Large supply of bike parking facilities throughout cities</li> <li>• State-of-the-art bicycle parking facilities at train stations</li> <li>• Strict time limit for parking or residents-only parking in urban neighborhoods</li> <li>• High parking prices in city centers (e.g. €1-4/hour in Berlin city center)</li> </ul>	<ul style="list-style-type: none"> <li>• Large supply of parking spaces for motor vehicles including ground parking lots and parking garages that are convenient and user-friendly throughout the city</li> <li>• Available parking hours based on specific locations</li> <li>• Low parking prices (e.g. \$1/hour for metered parking and free during some time)</li> </ul>
Taxation policies	<ul style="list-style-type: none"> <li>• High taxes/fees on private car ownership and use including high gas price</li> <li>• More than €1,500 to obtain a driver's license for fees and strict training requirements</li> </ul>	<ul style="list-style-type: none"> <li>• Much lower taxes/fees on private car ownership and use including lower gas price compared to Germany</li> <li>• Less than \$50 to obtain a driver's license</li> </ul>
Traffic laws	<ul style="list-style-type: none"> <li>• Cyclists' rights enforced by polices and courts including special protection for children and elderly cyclists</li> <li>• Motorists assumed legally to take charge of almost all crashes with cyclists</li> </ul>	<ul style="list-style-type: none"> <li>• Same rights and responsibilities as motorists</li> </ul>

Sources. City of Austin (2009); Pucher and Buehler (2008b), p.512 & 522

## 4.2 Community designs

Overall land use patterns and arrangements of cycling path networks are the two major factors that influence cycling levels. Cycling levels are higher in communities with more diverse land uses, higher density, and greater connectivity of street and cycling path networks, than communities with segregated land uses, low density, and poor connectivity (Saelens, Sallis, & Frank, 2003). Among the keys to the high level of cycling in Germany are the mixed-use developments and complete and continuous cycling networks for cities/towns/neighborhoods.

Even though the cycling level in Austin has increased greatly through a series of cycling policies and promotional programs during the past years, overall land use patterns and bikeway networks still make Austin cycling-unfriendly. Major destinations are too far for bicyclists because of segregated land use patterns and lower density developments. City street networks are designed for motorists, and incomplete cycling networks make cycling less convenient and more dangerous. Table 4 compares community design features related to cycling in Austin with those in German cities based on the six dimensions of urban design.

**Table 4 Community designs for cycling in German cities and Austin, Texas**

Dimensions	Specific approaches	
	German cities	Austin
Functional	<ul style="list-style-type: none"> <li>• Complete cycling systems/networks</li> </ul>	<ul style="list-style-type: none"> <li>• Incomplete cycling systems/networks with gaps and barriers</li> </ul>
Morphological	<ul style="list-style-type: none"> <li>• Appropriate land use to make major destinations close enough for cycling (shorter distance than auto-oriented developments while longer distance than pedestrian oriented developments)</li> </ul>	<ul style="list-style-type: none"> <li>• Segregated land use and low-density developments appropriate for automobile transportation (major destinations often not within a cycling distance)</li> </ul>
Perceptual	<ul style="list-style-type: none"> <li>• Clear and logical hierarchies with easy wayfinding for cycling network</li> </ul>	<ul style="list-style-type: none"> <li>• Unclear hierarchies of cycling networks that increase uncertain and unsafe feelings of cycling</li> </ul>
Social	<ul style="list-style-type: none"> <li>• Various destinations for different social groups of cyclists conveniently connected by cycling lanes</li> </ul>	<ul style="list-style-type: none"> <li>• Uneven distribution of cycling rates across different socioeconomic groups due to inconvenient and disconnected cycling networks</li> </ul>

Visual	<ul style="list-style-type: none"> <li>• Legible and attractive medium scale environments that can be optimally experienced at cyclists' speed</li> </ul>	<ul style="list-style-type: none"> <li>• Large scale environments that are not attractive for cyclists</li> </ul>
Temporal	<ul style="list-style-type: none"> <li>• Potential change of cycling networks over time</li> </ul>	<ul style="list-style-type: none"> <li>• No information/data available</li> </ul>

*Note.* Adapted from “ Urban Design: Is there a Distinctive View from the Bicycle?” by A. Forsyth & K. Krizek, 2011, *Journal of Urban Design*, 16(4), p.538

### 4.3 Infrastructure and facilities

According to Pucher and Buehler (2008b), cycling supportive infrastructure and facilities in Germany expanded greatly from the mid-1970s to the mid-1990s, including an increase of bikeway network from 12,911 kilometers (8,023 miles) in 1976 to 31,236 kilometers (19,409 miles) in 1996. In 2004, Berlin had a total of 1,140 kilometers (708 miles) of bikeway network, including “860 kilometers of completely separate bike paths, 60 kilometers of bike lanes on streets, 50 kilometers of bike lanes on sidewalks, 100 kilometers of mixed-use pedestrian-bike paths, and 70 kilometers of combined bus-bike lanes on streets” (Pucher & Buehler, 2008b, p. 511). By 2015, Bonn had a total of 300 kilometers (186 miles) of bikeways (City of Bonn, 2015).

The overall length of cycling facilities in Austin had almost doubled from 778 miles in 1998 to 1451 miles in 2008, with small portions that were separate bicycle lanes (see Table 5). Compared to 860 kilometers (534 miles, 1.57 miles per 10,000 persons) of completely separate bike paths in Berlin in 2004, only 211 kilometers (131 miles, 1.75 miles per 10,000 persons) of separate bicycle lanes were available in Austin in 2008 (see Table 6).

**Table 5 Growth of Austin cycling network facilities from 1998 to 2008 in miles**

	1998	2008
Multi-use paths	0.3	49.5
Bicycle lanes	73.3	130.9
Paved shoulders	216.8	286.7
Shared lane and wide curb lane streets	488.0	983.8
Total	778.4	1,450.9

*Sources.* City of Austin (2009), p.10

**Table 6 Completely separate bicycle lanes in Berlin and Austin**

	Berlin (2004)	Austin (2008)
Total length of separate bicycle lanes	860 kilometers / 534 miles	211 kilometers / 131 miles
Population	3,400,000	746,835
Length of separate bicycle lanes in miles per 10,000 persons	1.57	1.75

*Sources.* City of Austin (2009); Pucher and Buehler (2008b); US Census Bureau (2006-2008)

Currently, German cities have a comprehensive package of cycling facilities, including separate and shared cycling lanes, clear signage and signals, convenient and sufficient bicycle parking, appropriate lighting, advanced stop lines (bike boxes) and cycling crossings at intersections, etc. The four main types of cycling lanes depending on specific locations or needs of cyclists include: (1) completely separate circulation systems for cyclists versus motorized modes and pedestrians; (2) shared cycling lanes with motorized modes; (3) shared cycling lanes with pedestrians; and (4) shared cycling lanes with both motorized modes and pedestrians. Various types of bicycle parking are widely available in Germany, including both formal parking with racks at different scales and informal parking (e.g. street posts, poles, trees, etc.). Detailed designs are also essential to promote cycling-friendly environments. Detailed environmental features, such as signage, paving patterns, curb ramps, marked cycling crossings, and other artful cycling facilities, can improve safe, legible, and visually interesting built environments that are optimal when experienced at a speed of cyclists (Forsyth & Krizek, 2011). In contrast with German cities that have even distributions of cycling infrastructure and facilities, environmental supports for cycling in Austin is concentrated in city centers and areas around the universities. Table 7 shows a comparison between cycling infrastructure/facilities in Germany cities and Austin following the six dimensions of urban design.

**Table 7 Cycling supportive infrastructure and facilities in German cities and Austin, Texas**

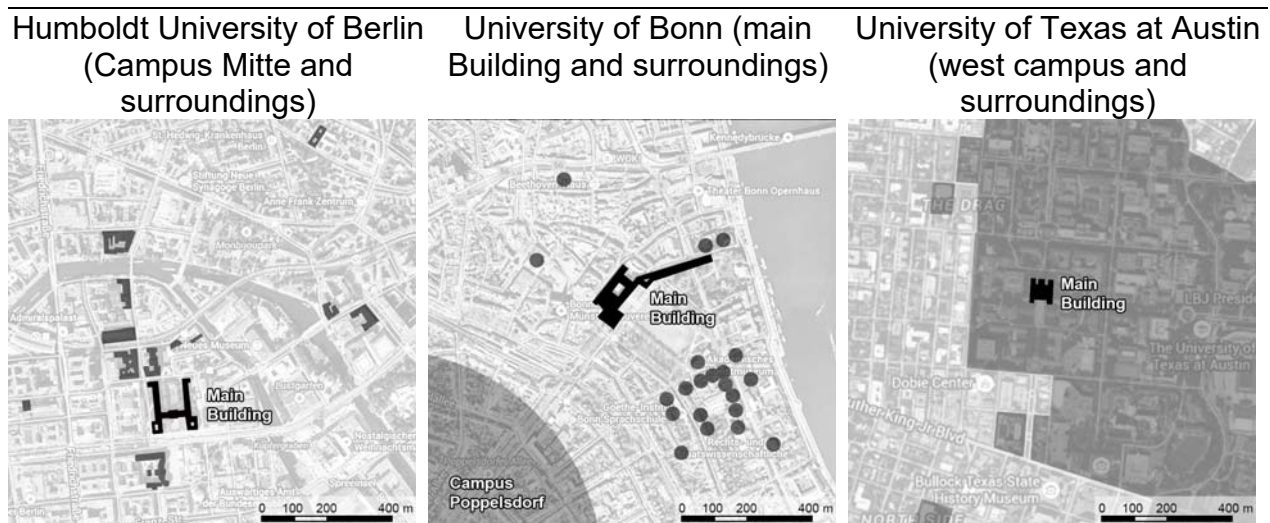
Dimensions	Specific approaches	
	German cities	Austin
Functional	<ul style="list-style-type: none"> <li>• Safe, convenient and well maintained cycling lanes and parking spaces</li> <li>• Appropriately signed and well-lit cycling and parking spaces to maximize cycling safety</li> </ul>	<ul style="list-style-type: none"> <li>• Disconnected bikeway network for the whole city</li> <li>• Partially well maintained cycling lanes</li> <li>• Limited parking spaces for bicycles</li> <li>• Plenty of unsigned bikeway</li> </ul>
Morphological	<ul style="list-style-type: none"> <li>• Design goals concerning openness or enclosure maintained by cycling lanes or bicycle parking</li> <li>• Spaces defined at the scale of cyclists regarding height and speed</li> </ul>	<ul style="list-style-type: none"> <li>• Limited spaces defined at the scale of cyclists regarding height and speed (most spaces defined and maintained at the scale of motorists)</li> </ul>
Perceptual	<ul style="list-style-type: none"> <li>• Clearly perceived built elements/details for cyclists as well as pedestrians and/or motorists</li> <li>• Cycling lanes with safe and attractive views for cyclists</li> </ul>	<ul style="list-style-type: none"> <li>• Lack of built elements/details and signage for cyclists</li> <li>• Narrow and unsafe cycling lanes in most area</li> </ul>
Social	<ul style="list-style-type: none"> <li>• Some travel lanes that are wide enough for cyclists to ride side by side</li> <li>• Availability for groups of cyclists to temporarily park and interact</li> </ul>	<ul style="list-style-type: none"> <li>• Limited spaces for groups of cyclists to temporarily park and interact</li> </ul>
Visual	<ul style="list-style-type: none"> <li>• A balance of diversity to create legible, efficient and attractive visual cues (e.g. signage, marked cycling crossings, etc.) rather than visual clutter for cyclists</li> </ul>	<ul style="list-style-type: none"> <li>• Limited and unclear cycling visual cues (e.g. signage, marked cycling crossings, etc.) that lack diversity and clarify</li> </ul>
Temporal	<ul style="list-style-type: none"> <li>• Potential change of supportive facilities over time (e.g. more parking spaces for bicycles, added cycling lanes, etc.)</li> <li>• Availability of snow removal during the winter season</li> <li>• Clear visibility of built elements/details during different seasons</li> <li>• Potential renewal of signage, paving patterns and colors, etc.</li> </ul>	<ul style="list-style-type: none"> <li>• No information/data available</li> </ul>

*Note.* Adapted from “Urban Design: Is there a Distinctive View from the Bicycle?” by A. Forsyth & K. Krizek, 2011, *Journal of Urban Design*, 16(4), p.538



#### 4.4 Cycling environments around the university campuses

According to the aerial maps of the 1,200m by 1,200m study areas in Figure 1, the most significant difference between the universities in German cities and Austin is that there is no clear boundary for the university campuses in Germany. University buildings are scattered throughout the cities without a clear campus boundary and are mostly located near the city centers in Germany. A mix of university buildings with other land uses such as commercial, residential, and recreational makes major destinations within an easy biking distance from the university campuses in Germany. Table 8 shows a more detailed comparison of cycling environments regarding the two study areas of community designs and infrastructure/facilities among the three selected university communities. Cycling environments are consistently safe and convenient throughout the areas within and outside the universities in Germany, while cycling infrastructure/facilities are much more complete within the University of Texas in Austin compared to the surroundings. Figure 2-4 displays a photographic inventory of cycling infrastructure/facilities located within the three university campuses and in the surroundings, including cycling lanes, cycling crossings, and bicycle parking.

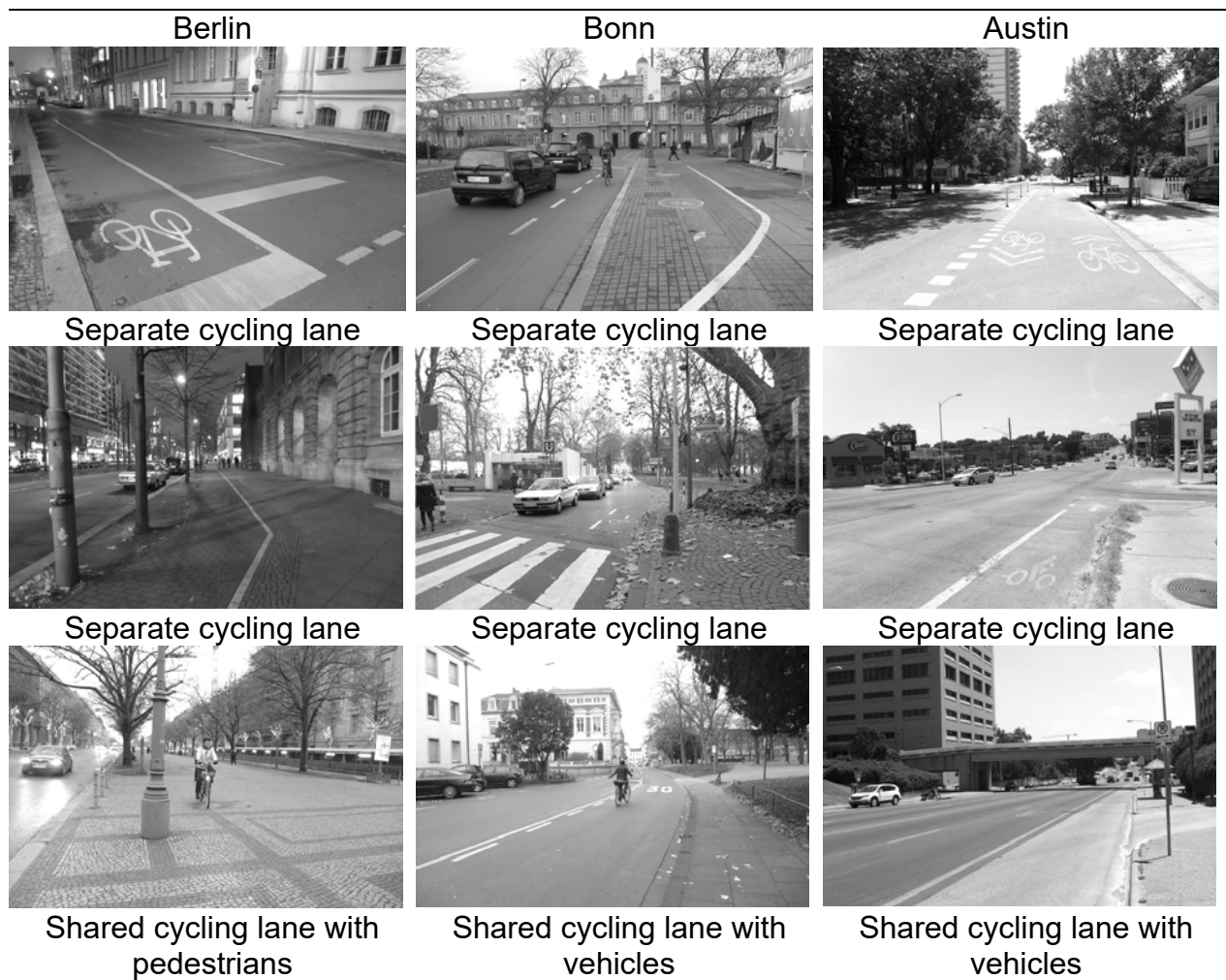


*Note.* All the main buildings are marked in black. For the Humboldt University of Berlin (left), the rest of the university buildings are marked in gray. For the University of Bonn (middle), buildings around the main building are roughly marked in gray dots, and the Campus Poppelsdorf is roughly marked in gray. For the University of Texas at Austin (right), the campus is marked in gray.

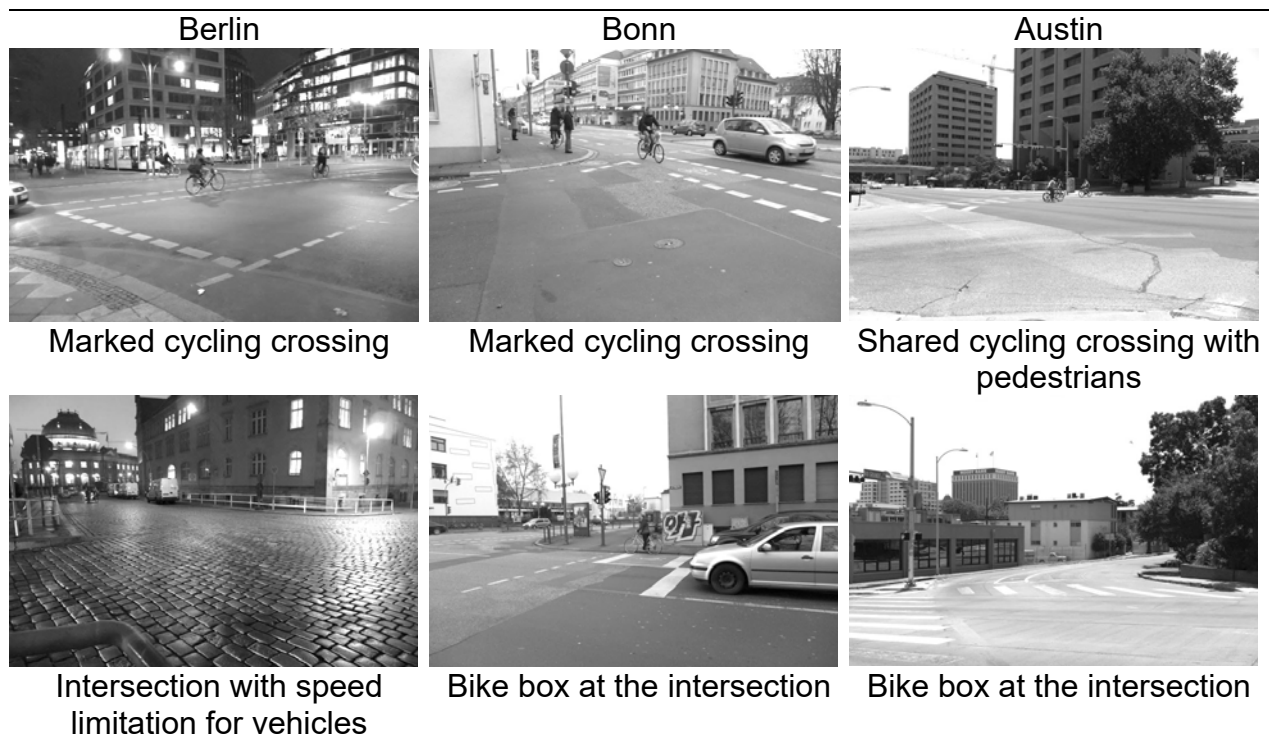
**Figure 1 Aerial maps of the 1,200m by 1,200m study areas**

**Table 8 Cycling environments around the university campuses in German cities and Austin, Texas**

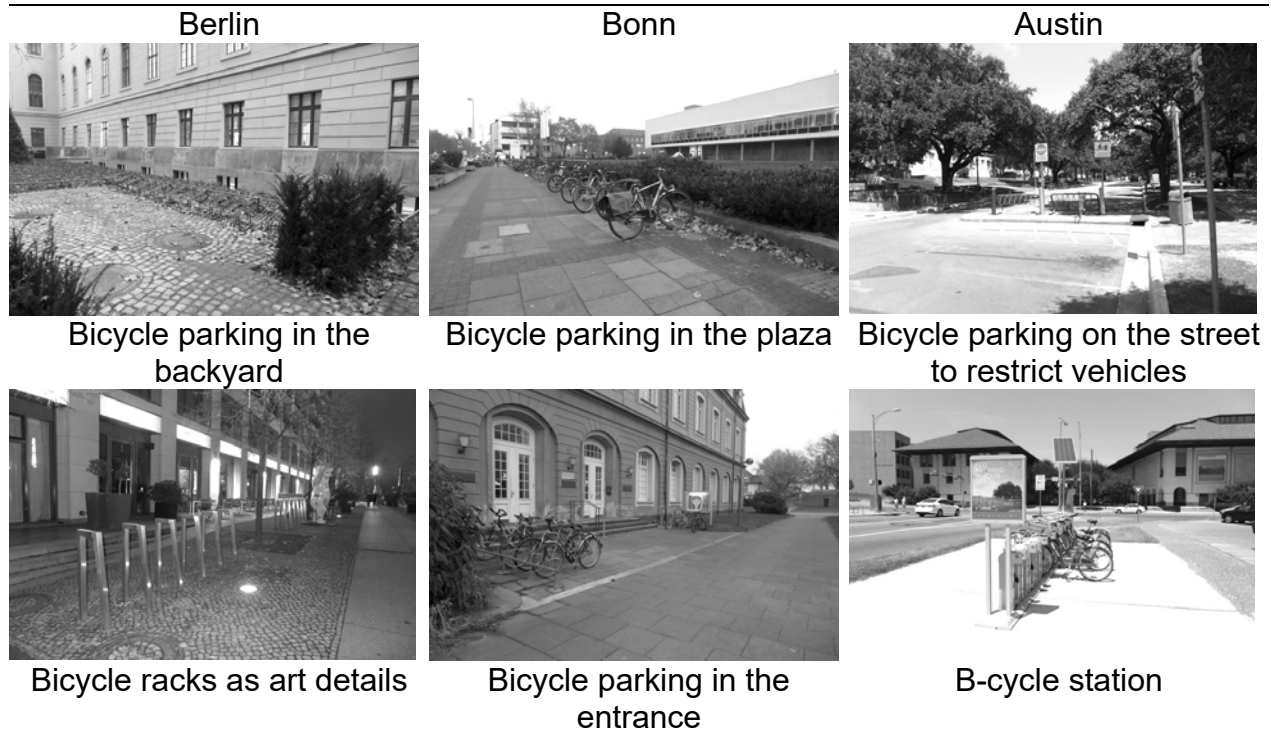
	German cities	Austin
Community designs	<ul style="list-style-type: none"><li>• University buildings are scattered in the cities without a clear boundary between the universities and the surrounding communities.</li><li>• Highly irregular city blocks and street patterns and orientations assist bicyclist and pedestrian movements through distinguishable visual cues and landmarks, while obstruct vehicle movements.</li><li>• Mixed land use and high-density city development make major destinations easily reachable within a biking distance.</li><li>• Safe, convenient and complete cycling networks are ramified all over the cities.</li></ul>	<ul style="list-style-type: none"><li>• Most university buildings are concentrated in a clearly delineated university district (less mixed land use compared to the universities in Germany).</li><li>• More regular city blocks and grid street patterns facilitate movements of vehicles.</li><li>• Segregated land use and low-density city development make major destinations within a driving distance rather than biking/walking distance.</li><li>• Incomplete and discontinuous cycling networks make cycling unsafe and inconvenient all over the city.</li></ul>
Infrastructure and facilities	<ul style="list-style-type: none"><li>• A mixed level of cycling lanes including completely separate cycling lanes and shared cycling lanes with vehicles or/and pedestrians are provided as appropriate.</li><li>• Bicycle parking spaces for both informal and formal facilities are available along streets, in major entrances, in courtyards, etc.</li><li>• Bike boxes and marked cycling crossings at intersections increase cycling safety and promote bicyclist movements.</li><li>• Marked cycling tracks, distinct paving patterns for cycling, and curb ramps improve cycling environments.</li><li>• Cycling facilities such as bicycle racks are combined with artful designs to help create interesting and attractive built environments.</li><li>• Well-lit cycling and parking spaces enhance cycling safety at night.</li></ul>	



**Figure 2 Cycling lanes in German cities and Austin, Texas**



**Figure 3 Cycling crossings at intersections in German cities and Austin, Texas**



**Figure 4 Bicycle parking in German cities and Austin, Texas**

## 1 CONCLUSIONS

The lower level of cycling in Austin compared to German cities is attributed to insufficient governmental policies and interventions, inadequate cycling facilities/environments, and the widespread automobile dependent lifestyles and culture. Table 9 summarizes major differences between German cities and Austin in terms of policies, community designs, and infrastructure and facilities. Drawing from the lessons learned from the German cities, important strategies that Austin may explore to promote cycling include: (a) comprehensive cycling system and improved cycling environments, (b) cycling related education and promotional programs/events, (c) restrictions on car use, and (d) promotion of cyclists' rights.

**Table 9 Summary of major variations in cycling environments between German cities and Austin, Texas**

	German cities	Austin
Policies	<ul style="list-style-type: none"> <li>• Complete street: multi-modal transportation to integrate the bicycle system with transit</li> <li>• High speed limitations (e.g. 30 kilometers/hour [19 miles/hour] or less in residential neighborhoods)</li> <li>• Strict time limit for parking or residents-only parking in urban neighborhoods</li> <li>• High parking prices</li> <li>• Cyclists' rights more strongly enforced than the motorists' rights</li> </ul>	<ul style="list-style-type: none"> <li>• Complete street: multi-modal transportation to integrate the bicycle system with transit (underway)</li> <li>• Low speed limitations (e.g. 48 kilometers/hour [30 miles/hour] or less in residential neighborhoods)</li> <li>• Little time limit for parking</li> <li>• Low parking prices</li> <li>• Same rights and responsibilities as motorists</li> </ul>
Community designs	<ul style="list-style-type: none"> <li>• Mixed land use</li> <li>• High-density development</li> <li>• Complete and continuous cycling network</li> <li>• Clear hierarchies of cycling networks</li> <li>• Legible and attractive large scale environments at cyclists' speed</li> </ul>	<ul style="list-style-type: none"> <li>• Segregated land use</li> <li>• Low-density development</li> <li>• Incomplete and discontinuous cycling network</li> <li>• Unclear hierarchies of cycling networks</li> <li>• Unattractive large scale environments at cyclists' speed</li> </ul>
Infrastructure and facilities	<ul style="list-style-type: none"> <li>• High maintenance</li> <li>• Limited vehicle parking spaces</li> <li>• Large supply of bike parking facilities throughout the city</li> <li>• Legible, efficient and attractive visual cues/details (e.g. marked crossings at intersections)</li> </ul>	<ul style="list-style-type: none"> <li>• Low maintenance</li> <li>• Large supply of vehicle parking spaces throughout the city</li> <li>• Limited bike parking facilities except for city center and university areas</li> <li>• Lack of visual cues/details (e.g. unmarked crossings at intersections)</li> </ul>

## 2 DISCUSSIONS

### 2.1 Challenges for Texas cities

Even though there is an urgent need for promoting cycling environments in Austin as well as in many other cities in Texas and beyond, challenges regarding existing city layouts and infrastructure, climate and topographic conditions, and traditional lifestyles and culture make cycling related strategies difficult to

be implemented in American communities. Current city zoning and land use patterns in Texas cities follow motor-oriented urban design/plan solutions, making automobiles necessary for people to get around cities. Automobile dependent lifestyles and culture are widely accepted, which allows citizens in Texas to view cars as the only or most convenient way to make their daily trips. Most existing streets in Texas cities are designed for vehicles, without adequate accommodation of bicyclists. Building facades and streetscape are often boring without sufficient visual interests or wayfinding guidance for cyclists. The high temperature and humidity in many months of the year and topographic changes with moderate to steep slope in some Texas cities make cycling even less feasible or attractive.

## **2.2 Cycling-friendly community design principles for Texas cities**

Due to the challenges mentioned above, promoting cycling in Texas cities is a long-term process that needs efforts from governments, urban designers/planners, and other related professionals. Governmental policies and interventions should emphasize the importance of cycling and provide measures and funding to encourage bicycle use. Cyclist-friendly urban design approaches are needed to take cycling experiences more seriously during the policy decision-making processes. The following cycling-friendly community design principles may be considered to encourage cycling in Austin and other Texas cities:

- 1) Create complete cycling systems with sufficient supplies of cycling lanes, cycling crossings, bicycle parking, signage, and other cycling supportive facilities and details;
- 2) Encourage complete streets with efficient multi-modal transport systems to incorporate bicycle with transit;
- 3) Provide policies and interventions to restrict private vehicle use while encourage public transportation and cycling; and
- 4) Promote diverse and mixed land uses and high-density developments with better connectivity of street and cycling path networks.

This is a case study and has several limitations. First, the study communities in Germany and in Texas are selected for the feasibility of carrying out the study given the ability to visit the cities and collect

the necessary data. While the 1200m by 1200m site selected for the detailed analyses were selected to ensure some comparability, it is possible that additional/different findings could be extracted if other or more areas were used in the assessments. Second, due to the limited data availability, some of the discussions were made based on the personal observations of the authors and subject to different interpretations. Third, another related limitation is the reliance on the use of primarily qualitative methods. Future work utilizing more objective data and additional sites/communities or analysis dimensions can further contribute to understanding cycling environments that are appropriate for promoting cycling in different countries, communities and/or populations.

### References

- Bassett, D. R., Pucher, J., Buehler, R., Thompson, D. L., & Crouter, S. E. (2008). Walking, cycling, and obesity rates in Europe, North America, and Australia. *Journal of Physical Activity and Health*, 5(6), 795-814. Retrieved from <http://www.ncbi.nlm.nih.gov/pubmed/19164816>
- Buehler, R., & Pucher, J. (2009). Sustainable transport that works: Lessons from Germany. *Journal of World Transport Policy and Practice*, 15(1), 13-46. Retrieved from <http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.192.1709&rep=rep1&type=pdf> - page=13
- Buehler, R., & Pucher, J. (2011). Sustainable transport in Freiburg: lessons from Germany's environmental capital. *International Journal of Sustainable Transportation*, 5(1), 43-70. doi:10.1080/15568311003650531
- Buehler, R., Pucher, J., Merom, D., & Bauman, A. (2011). Active travel in Germany and the U.S. Contributions of daily walking and cycling to physical activity. *American Journal of Preventive Medicine*, 41(3), 241-250. doi:10.1016/j.amepre.2011.04.012



- Centers for Disease Control and Prevention. (2011). *Obesity Trends Among U.S. Adults Between 1985 and 2010*. Retrieved from <http://stacks.cdc.gov/view/cdc/5959/>
- City of Austin. (2009). *Austin 2009 Bicycle Plan Update*. Retrieved from [http://www.pedbikeinfo.org/pdf/PlanDesign\\_SamplePlans\\_Local\\_Austin2009.pdf](http://www.pedbikeinfo.org/pdf/PlanDesign_SamplePlans_Local_Austin2009.pdf)
- City of Bonn. (2015, July 7). Cycling. Retrieved August 23, 2015, from [https://www.bonn.de/tourismus\\_kultur\\_sport\\_freizeit/tourist\\_information\\_aktuell/freizeit\\_natur\\_sport/11225/index.html?lang=en](https://www.bonn.de/tourismus_kultur_sport_freizeit/tourist_information_aktuell/freizeit_natur_sport/11225/index.html?lang=en)
- City Population. (2015a, December 17). BONN (Bonn). Retrieved, from <http://www.citypopulation.de/php/germany-nordrheinwestfalen.php?cityid=05314000>
- City Population. (2015b, September 25). GERMANY: Berlin. Retrieved, from <http://www.citypopulation.de/Deutschland-Berlin.html>
- Federal Ministry of Transport. (2012). *National Cycling Plan 2020: Joining forces to evolve cycling*. Retrieved from <http://www.nationaler-radverkehrsplan.de>
- Finkelstein, E. A., Trogon, J. G., Cohen, J. W., & Dietz, W. (2009). Annual medical spending attributable to obesity: payer-and service-specific estimates. *Health Affairs*, 28(5), w822-831. doi:10.1377/hlthaff.28.5.w822
- Forsyth, A., & Krizek, K. (2011). Urban Design: Is there a Distinctive View from the Bicycle? *Journal of Urban Design*, 16(4), 531-549. doi:10.1080/13574809.2011.586239
- Huy, C., Becker, S., Gomolinsky, U., Klein, T., & Thiel, A. (2008). Health, medical risk factors, and bicycle use in everyday life in the over-50 population. *Journal of Aging and Physical Activity*, 16(4), 454-464. Retrieved from <http://www.ncbi.nlm.nih.gov/pubmed/19033605>

- Jebb, S. A., & Moore, M. S. (1999). Contribution of a sedentary lifestyle and inactivity to the etiology of overweight and obesity: current evidence and research issues. *Medicine and Science in Sports and Exercise*, 31(11 Suppl), S534-541. doi:10.1097/00005768-199911001-00008
- McKenzie, B. (2014). Modes less traveled—bicycling and walking to work in the United States: 2008–2012. *US Census Bureau, New York*. Retrieved from <https://www.census.gov/prod/2014pubs/acs-25.pdf>
- Mokdad, A. H., Marks, J. S., Stroup, D. F., & Gerberding, J. L. (2004). Actual causes of death in the United States, 2000. *Journal of the American Medical Association*, 291(10), 1238-1245. doi:10.1001/jama.291.10.1238
- Oja, P., Mänttari, A., Heinonen, A., Kukkonen-Harjula, K., Laukkanen, R., Pasanen, M., & Vuori, I. (1991). Physiological effects of walking and cycling to work. *Scandinavian Journal of Medicine and Science in Sports*, 1(3), 151-157. doi:10.1111/j.1600-0838.1991.tb00288.x
- Pucher, J., & Buehler, R. (2008a). Cycling for everyone: lessons from Europe. *Transportation Research Record: Journal of the Transportation Research Board*, 2074, 58-65. doi:10.3141/2074-08
- Pucher, J., & Buehler, R. (2008b). Making Cycling Irresistible: Lessons from The Netherlands, Denmark and Germany. *Transport Reviews*, 28(4), 495-528. doi:10.1080/01441640701806612
- Pucher, J., & Buehler, R. (2009). Cycling for a few or for everyone: The importance of social justice in cycling policy. *World Transport Policy & Practice*, 15(1), 57-64. Retrieved from [http://www.vtpi.org/pucher\\_buehler\\_cycling.pdf](http://www.vtpi.org/pucher_buehler_cycling.pdf)

- Pucher, J., & Buehler, R. (2010). Walking and cycling for healthy cities. *Built Environment*, 36(4), 391-414. doi:<http://dx.doi.org.ezproxy.library.tamu.edu/10.2148/benv.36.4.391>
- Pucher, J., Buehler, R., Bassett, D. R., & Dannenberg, A. L. (2010). Walking and cycling to health: a comparative analysis of city, state, and international data. *American Journal of Public Health*, 100(10), 1986-1992. doi:10.2105/AJPH.2009.189324
- Pucher, J., Buehler, R., & Seinen, M. (2011). Bicycling renaissance in North America? An update and re-appraisal of cycling trends and policies. *Transportation research part A: policy and practice*, 45(6), 451-475. doi:10.1016/j.tra.2011.03.001
- Pucher, J., & Dijkstra, L. (2000). Making walking and cycling safer: lessons from Europe. *Transportation Quarterly*, 54(3), 25-50. Retrieved from <http://www.ta.org.br/site/Banco/7manuais/VTPIpuchertq.pdf>
- Pucher, J., & Dijkstra, L. (2003). Promoting safe walking and cycling to improve public health: lessons from the Netherlands and Germany. *American Journal of Public Health*, 93(9), 1509-1516. doi:10.2105/AJPH.93.9.1509
- Saelens, B. E., Sallis, J. F., & Frank, L. D. (2003). Environmental correlates of walking and cycling: findings from the transportation, urban design, and planning literatures. *Annals of Behavioral Medicine*, 25(2), 80-91. doi:10.1207/S15324796ABM2502\_03
- The Humboldt University of Berlin. (2016, January 5). Facts and Figures. Retrieved, from <https://www.hu-berlin.de/en/about/humboldt-universitaet-zu-berlin/facts>
- The University of Bonn. (2014, July). The University of Bonn at a glance. Retrieved, from <https://www.uni-bonn.de/the-university/the-university-of-bonn-at-a-glance>
- The University of Texas at Austin. (2015, December 1). Facts & Figures. Retrieved, from <https://www.utexas.edu/about/facts-and-figures>

US Census Bureau. (2006-2008). 2006-2008 American Community Survey. Retrieved from:

[http://factfinder.census.gov/faces/tableservices/jsf/pages/productview.xhtml?pid=ACS\\_08\\_3YR\\_B01003&prodType=table](http://factfinder.census.gov/faces/tableservices/jsf/pages/productview.xhtml?pid=ACS_08_3YR_B01003&prodType=table)

US Census Bureau. (2010-2014). 2010-2014 American Community Survey 5-Year Estimates.

Retrieved from:

[http://factfinder.census.gov/faces/tableservices/jsf/pages/productview.xhtml?pid=ACS\\_13\\_5YR\\_S0801&prodType=table](http://factfinder.census.gov/faces/tableservices/jsf/pages/productview.xhtml?pid=ACS_13_5YR_S0801&prodType=table)

Wen, L. M., Orr, N., Millett, C., & Rissel, C. (2006). Driving to work and overweight and obesity: findings from the 2003 New South Wales Health Survey, Australia. *International Journal of Obesity*, 30(5), 782-786. doi:10.1038/sj.ijo.0803199

Wen, L. M., & Rissel, C. (2008). Inverse associations between cycling to work, public transport, and overweight and obesity: findings from a population based study in Australia. *Preventive Medicine*, 46(1), 29-32. doi:10.1016/j.ypmed.2007.08.009

#### **Sinan Zhong**

Sinan Zhong is a second year Ph.D. student in Urban and Regional Science at Texas A&M University. She received her Master of Landscape Architecture degree and Certificate of Health Systems and Design from Texas A&M University in 2014. Ms. Zhong's research interests include transportation and land use planning, spatial pattern and physical activity, built environment and human behavior, and sustainable and healthy community development.

#### **Dr. Chanam Lee**

Dr. Chanam Lee is a Professor of Landscape Architecture and Urban Planning in the College of Architecture at Texas A&M University. Dr. Lee received her Ph.D. in Urban Design and Planning from the University of Washington. She currently directs a research group, Design Research for Active Living, devoted to interdisciplinary research aimed at linking elements of the built environment with health behaviors and outcomes. She is a fellow in the Center for Health Systems and Design, and adjunct faculty with the Department of Social and Behavioral Health.

# **A STRATEGIC CONCEPT OF MULTIPLE OBJECTIVE ECOLOGICAL OPTIMIZATION IN RURAL LANDSCAPE PLANNING AND DESIGN IN SOUTHERN ZHEJIANG, CHINA**

**ZHAO, TIE-ZHEN**

Associate Professor, Program of Urban and rural planning & cultural geography , Shanghai Institute of Tourism of Shanghai Normal University, China

**ZHAO, YANG**

Associate Professor, Program of Landscape Architecture, School of Ecological Technology and Engineering, Shanghai Institute of Technology, China

## **ABSTRACT**

*During the process of rural rehabilitation in contemporary China, the multiple objective planning such as land use and environmental protection should be integrated into one united system. Ecological ideas should play a leading role in the rural landscape planning and design. This study tried to apply a strategic concept of Multiple Objective Ecological Optimization (Eco-optim+) through the process of rural industry development, ecological livable environment construction, ecological conservation and usage, and landscape heritage protection and restoration. Eight villages were used as field cases to examine this concept in Southern Zhejiang, China. A method of ecological landscape performance evaluation was used to study the cases' social and cultural factors. The indicators of Eco-optim+ concept in rural landscape planning could be summarized as follows:*

- The ecological optimization in the transformation of rural industry from farming to the tertiary industry sector;*
- The ecological inhabitance improvement as a key factor in rural landscape planning;*
- The ecological environment conservation under strict ecological red-line control;*
- The livable landscape in the integration of rural landscape heritage protection and restoration with ecological inhabitance and ecological industry under sustainable development guidelines.*

*For detailed landscape design indicators, the "progressive improvement" as an important guideline was demonstrated by two case studies of village landscape design. As a problem-oriented study, this paper also illuminated the imminent issues in the rural landscape scenarios, including:*

- The endangered rural ecological environment in mountain areas, as a result of the excessive sprawl of nursery stock industry to destroy ground nature for the commercial need of urban greening;*
- The demolition, relocation and merge of traditional villages in the past 10 years;*

*Instead of passive protection, initiative act will be encouraged in the rural ecological construction procession through the regional coordinated development with the introduction of ecological health caring and recreation industry on the basis of rural ecological protection and water conservation. The cultural restoration and cultural ecology value should be highly emphasized with the support of law binding system to rein the commercial rush of "fake antique landscape construction."*

*In conclusion, the Eco-optim+ concept in rural landscape planning and design will attract wide attention in modern China. It is necessary to promote rural landscape planning as a key interweaving thread in social, economic, and living landscape integration under the guidance of sustainable development.*

## **1.1 Keywords**

Rural, Ecological Optimization, Sustainable Development, Ecological Landscape Performance

## **1 INTRODUCTION**

Along with the progress of new rural construction in modern China, the traditional hierarchical planning form of equally concerning for production, life, ecology has been transformed to the emphasis onto the Multiple Objective Ecological Optimization (Eco-optim+). The multiple objective planning such as land use and environmental protection should be integrated into one united system through gradually upgrade and transformation. Corresponding to this, the goal of rural landscape planning and design should go beyond seeking the traditional landscape satisfaction of space construction and heritage protection. The future development will indicate more prominent urge of ecological planning leading the "active" living landscape characteristics, committed to sustainable development goals. The concept of "Eco-optim+" highlights the development and optimization of the comprehensive ecological progress in the rural areas, and reflects the "1+1 is greater than 2". In fact, the "Eco-optim+" concept will be introduced as the core spirit of the guiding ideology for the common control platform in coordinating the land use control, urban and rural planning, environmental management in rural areas, as well as for the rural landscape development in future days.

## **2 RESEARCH BOJECT AND FEATURES**

In this paper the rural villages landscape planning and design study has focused on the rural villages which are considerable traditional natural livable villages with corresponding landscape heritage features, mainly feeding on agriculture and tertiary industry. Case studies illustration has selected 8 typical beautiful countryside villages within the range of Siming Mountain area in southern Zhejiang province.(Fig.01)



Fig.01:The Ecological Zone of Siming Mountain Range, South Zhejiang Province, China.

The featured villages with prominent rural landscape style appear to exhibit characteristics of both “Macrocosm Scenic Area Extension” and “Eco-optim+”. “Macrocosm Scenic Area Extension” will contribute to the integrating of the protection system for “China's Famous Villages of Historic and Cultural” and “China Traditional Villages”, with the regional village construction and development of the humanistic achievements, as well as the neighboring natural landscape heritage preservation, reducing man-made environmental disturbance and destruction, leading villagers in rural community to achieve harmony of rural production, life and the development of rural tourism altogether. Meanwhile through “Eco-optim+” and rural multi regulatory onto one united platform, the future rural path of development will be illuminated with the transformation and upgrading featuring multi aspects concerning for rural society, economy, life, ecology issues.

## **2. “ECO-OPTIM+” AS LEADING ROLE IN THE RURAL LANDSCAPE PLANNING AND DESIGN: THE CASE STUDY OF RURAL LANDSCAPE PLANNING**

Taking the example villages in the range of Siming Mountain of the beautiful countryside in South Zhejiang province of China, the following aspects lineup the prominent characteristics indicating the “Eco-optim+” concept effects in leading the ecological development path.

### **2.1. The development and transformation of rural industry featuring the ecological optimization and promotion**

In the rural landscape planning and construction cases study for Ningbo Shilin village and Dashan village which highlights the transformation of rural industrial development path, the traditional unified agriculture farming has been upgraded to the sustainable development of scenic tourism, ecological tourism and the accordingly tertiary industry types (Fig. 02).



Fig.02: Shilin Village, Ningbo (Source: Zhejiang Urban and Rural Planning Design Institute).

## 2.2. livable life ecological optimization and upgrading

In the rural landscape planning and construction cases study for Ningbo Yuyao Hengkantou village and Tanglizhang village which illustrates the livable rural theme as the core rural service idea, the planners had taken efforts in committing to serve the local population and comprehensive demand of ecological dwelling tourists based on applying the ecological planning concept and the harmony between man and nature living planning thought in establishing livable happy village homeland (Fig. 03).



Fig.03: Hengkantou Village, Ningbo.



### 2.3. rural ecological conservation and utilization

As to the landscape planning for villages located in the regional ecological conservation area such as Ningbo Jinguan village and JiaoHu village, the ecological red line control must be the guideline to be strictly complied with. The organic synthesizing of ecological space and landscape space is encouraged on the basis of ecological conservation, with carefully planning of ecological environmental protection experiencing and ecological outdoor recreation and sports theme, which will help to promote the passive protection to active ecological usage (Fig. 04, 05, 06, 07).



Fig.04: The Ecological Zone of Jinguan Village and JiaoHu Village, Ningbo, South Zhejiang Province, China.



Fig.05: Jinguan Village, Ningbo.

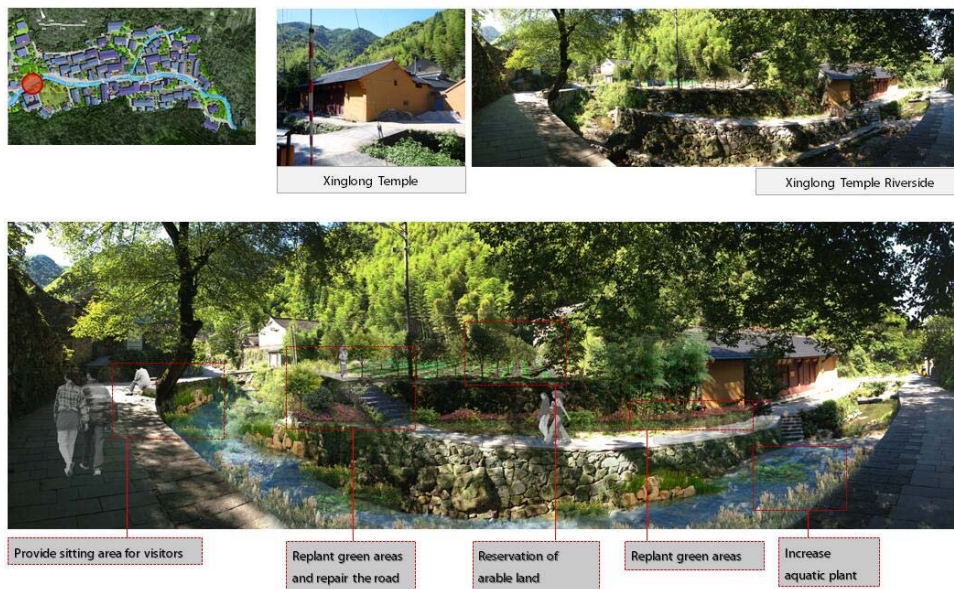


Fig.06: Jinguan Village, Ningbo





Fig.07: Jinguan Village, Ningbo

## 2.4. landscape heritage protection and restoration

For the landscape planning of traditional rural village cases featuring valuable cultural landscape heritage characteristics such as Ningbo Xujiashan village and Yuyao Zhongcun village, the protect-only thought must be avoided in construction practice. The protection and restoration demands varies for different areas from core protection district, historical and cultural area of conservation and restoration, to regional landscape coordination area and peripheral village domain environment. Accordingly the ecological inhabitance and healthy ecological industry development must be taken into consideration in the collaborative planning course to construct "living" heritage villages (Figure 8).



Fig.08: Xujiashan Village, Ningbo

### 3. THINKING FOR THE RURAL VILLAGE LANDSCAPE DESIGN NODE BASED ON THE “ECO-OPTIM+”IDEOLOGY

Ten years ago, the prevailing idea of planning guidance for the construction of the ideal rural landscape environment in China had been formatting the artificial unified village landscape poker face appearance, applying the urban landscape design system and construction methods. While the introducing of contemporary rural landscape design concept based on the “Eco-optim+”ideology encourages the gradual progressing improvement and customized landscape design node creation. The essential ecological thinking has been focused on the consideration of economic rationality and environmental conservation, and sustainable development consistency.

Taking the case study of landscape architecture renovation design for Ningbo Shilin village along the scenic greenway as example, designers had meticulously set up key landscape nodes such as the village entry plaza, the giant persimmon tree square, the stereo ecological parking space with differed vertical elevation, using the design method of local context concerning and ecological optimization with the expression of culture taste (Fig. 09, 10).



Fig.09: Shilin Village, Ningbo development (Figure 11, 12, 13).



Fig.11: Fuchun River Shishe Camphor Tribal Resort 1



Fig.12: Fuchun River Shishe Camphor Tribal Resort 2



Fig.13: Fuchun River Shishe Camphor Tribal Resort 3

#### **4. THE PROBLEMS AND COUNTERMEASURES IN THE CONTEMPORARY DEVELOPMENT OF RURAL LANDSCAPE ARCHITECTURE CONSTRUCTION**

##### **4.1. rural industry: the prominent ecological problems**

In southern China rural industry has become the ever hot issue riding the reforming and opening up to the outside world tide during last 2 decades, holding the slogan flag of every family getting rich. Recently the most prominent problem for southern Zhejiang rural villages had been the dilemma of establishing new industry and eliminating outdated ones. The villages in Siming Mountain area had been heavily dependent on the Landscape Nursery Industry, and the flower industry. Problem is: After ten years of maximizing the economic benefits with the plant soil ball lashing sales and repeated addition of dense planting, and the intensive use of agricultural pesticides, the overall regional mountain soil erosion problem has been so serious that the result of nutrition soil damage and the upstream soil pollution and drinking water source pollution problem has turned into potential deterioration as to seriously harm to the life health of the rural residents.

Actually the endangered situation would reach the adverse impact of manmade ecological disaster. To counter this ecological restoration process will be extremely long and difficult. The paradox is that all the mountain green planting for quick sell, and the topsoil stripping and the formation of patches of brown forest scar, all the ecological damage, had been the result of landscape construction plantation rush contributing to the quick urbanization development. Even if the green landscape image of mountain area plantation is visually pretty, it still is the deviation from the natural and ecological “green” landscape spirit.

Towards recently as the China urban construction process slowing down, such unsustainable patterns of industry development finally face the decline. It is great opportunity for the local policy makers to draw the new sketch plan of ecological optimization and transformation, giving full play to the superiority of the recycling industry, green industry, the booming ecological leisure



tourism, and rural leisure tourism (the agritainment, farm stay, Yang Kellogg, etc.). The listed green industry patterns had replaced the nursery industry with the advantages of comprehensively coordinating of rural resources, benefiting the conservation and maintenance of the fragile ecological environment, with the establishing of sustainable development mode towards healthy innovation. The success of many green resort projects in Hangzhou Deqing mountain area following the lead of leisure tourism industry can be used as reference to the corresponding case examples. To solve the problem of the current and the future will be through the natural evolving of the market economy and the government's administrative guidance. However the regional ecological restoration process is such challenging task enough to give everyone profound lesson to learn from in many years.

Another problem is the outdated rural industry (mostly polluting industry) facing the pressure of the elimination of backward production capacity in the new era as the maturing of regional industrial development model process. Meanwhile the above old industry will be directed to move to Industrial Park during which course the government guidance and regulation will play a leading role for regional planning strategic coordination.

#### **4.2. Rural village merge, demolition and population issues**

Except for disaster prevention purpose, new state regulation has banned the arbitrary action of rural merge, demolition and the removal of villages resident of the agricultural population. It is strictly prohibited to overall migrate rural population for the purpose of the whole rural village commercial rental to urban developers. The reason rural village is still the village lies in the adherence to the people in the rural homeland based on rural community construction and maintenance. The excessive outsiders' intervention is not conducive to the balance of the rural ecological living environment, rural industry, to achieve the sustainable development, neither for the sustainable development of rural culture and spiritual ecology. Anyway the harmonious

development of human culture and nature has always been the cornerstone of rural landscape architecture construction.

#### **4.3. initiative in ecological construction and regional coordination**

Observing from the construction and development case study of Ningbo Yuyao Lizhou Ecological Conservation Zone, the passive protection thinking has limited the comprehensive usage of high-quality ecological resources as the area was originally set up for the water resource conservation area and mountain forest nursery area. In this area the lacking of systematic coordination plan resulted in the fragmented situation for the Jinguan village (high-quality municipal traditional village), the upstream Jiao Hu Village, the old historical and cultural ecological greenway, the reservoir scenic area and other resources. Regional cooperation should be strengthened to establish the ecological health recreational therapy system and the scenic trail system, to expand the health industry and ecological industry interweaving, guiding the ecological optimization to creating a comprehensive ecological suburb natural oxygen bar based on the regional ecological resources system.

#### **4.4. cultural ecology and cultural reconstruction**

In recent years there has been the sad reality of demolition of the real historical heritage with fake antique building replacement in the city historical and cultural area of quite a lot China cities, for the pursuit of commercial interests and to create the so-called "image-building projects" and "achievement projects". During the process of rural traditional villages and the landscape heritage protection and restoration such similarly absurdity keeps happening. Village harmony and natural features as the core level of the rural landscape architecture had been destroyed by the construction of blunt artificial landscape scenes.



There had been two main reasons for this: the recklessness of pursuing commercial profit and the absence of village regulation. The latter one should be paid great attention because the traditional rural areas law system for planning and construction regulation had always been incomplete in China. Countermeasures should be taken into efforts to strengthen the accordingly administrative control with the advocating of urban and rural planning and cultural heritage protecting. The examples of successful protection and heritage tourism development and construction mode should be set up for the followers to learn from. The secret has always been to adjust measures to local conditions, guiding rural construction to seek balance in conservation and development of Humanities and green ecological road of sustainable development. More comprehensive methods should be introduced to better understanding the rural situation on multiple layers. There has been a cultural ecology evaluation program by the authors' team based on the merit of fuzzy theory is still in progress during this paper's writing time for the above listed villages to help to assess the landscape improvement effect on society layer.(Fig.14).

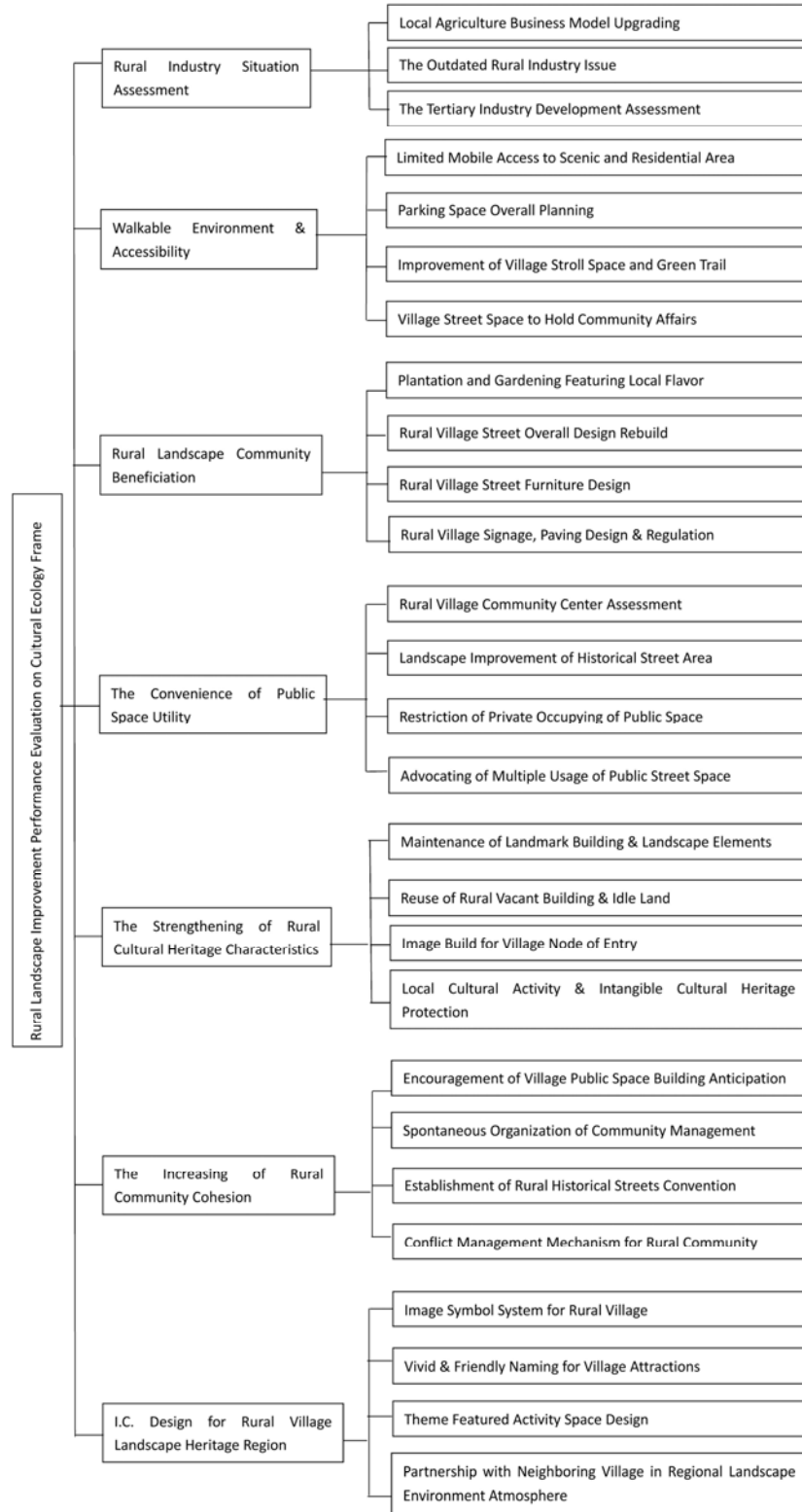


Fig.14 Rural Landscape Improvement Evaluation on Cultural Ecology Frame

## 5 CONCLUSION

The key for the success of rural landscape construction is ecological construction. It is committed to reach the integration of rural life, rural industry, and the ecological harmonious rural community living environment. In this process, for different villages, there is no mature and unified single mode of development.

In the new era with the China central government promotion of integrating multiple planning into one common platform, the traditional development style needs to turn from external increment to intension existent development. Accordingly the rural landscape planning and design will also be transformed into a process of gradual improvement, with the coordination of ecological intensive land utilization in planning and design patterns.

Since 2014 China government has defined the ecological redline for strict protection on key ecological functional zones, areas of sensitive and fragile ecological environment by The Ministry of Environmental Protection. Meanwhile the rural ecological red line of permanent farmland geographical delimitation system has been delineated by the Ministry of Land and Resources. These national mandatory requirements will definitely bring far-reaching influence on the existing regional industrial restructuring process and the future ecological industry development.

In this context the aim of introducing the “Eco-optim+” concept, is to optimize the existing development model focusing on ecological development as leading role, turning the hierarchical array of rural production, rural life, ecological development, to the integration of multiple planning and the construction of common administration platform. The rural landscape background is different from the urban landscape counterpart for its highly ecological fragility and ecological complexity in characteristics. Gradually the “image building project” and the mountain area nursery with potential ecological damage, etc. will be discarded and transformed to establish the healthy and harmonious sustainable development path for rural areas.

Chinese ideologist Mr. Liang Shuming had said in his <Rural construction theory- 1937>:“one hundred years of history, it can be said is a village history of the destruction of”. In order to prevent the worsening of such tragic situation efforts should be taken in rural landscape planning and design to achieve the coordination of ecological quality control, rural management optimization, and rural spiritual culture construction, to create the harmonious happy homeland of better life for rural villagers and rural landscape attractions experiencers.

*Note: All the images were form the author's photography and design works selection , except for the clear indication of source one ( Fig02 ) .*

## 6 REFERENCES

1. Binyi Liu, Wei Chen, *Thoughts on the Contemporary Rural Landscape Planning &.Construction, Small Town Construction*, 2005(09):45-47
2. Shouying Liu, *The Modernization &.Transformation of China Agriculture, Global Finance*, 2015(07)
3. Qi Lu, Ziruo Li, *Time &.Region-Rural Landscape Rethink on Landscape Architecture Science Aspect, Landscape Architecture*, 2013(04):56-60
4. Jinshi Zhang, *The Meaning of Rural Landscape in Landscape Architecture Planning &. Design*, Beijing Forest University, 2006

## BIOS

### **TieZheng Zhao , PH.D. of Architecture**

Associate Professor, Program of Urban and rural planning & cultural geography , Shanghai Institute of Tourism of Shanghai Normal University, China.

Dr. Zhao's areas of study interest are Urban Infrastructure planning, rural landscape architecture planning, landscape heritage protection &.restoration planning, tourism planning &.resort design of south China.

E-mail: [crimsonbudasky@gmail.com](mailto:crimsonbudasky@gmail.com)

### **Yang Zhao, Ph.D. Candidate of Landscape Architecture,**

Associate Professor, Program of Landscape Architecture , School of Ecological technology and engineering, Shanghai Institute of Technology, China.

Zhao's areas of interest are study for the urban park renewal, green infrastructure planning, and rural landscape design of south China.

E-mail: [zhaoyang@sit.edu.cn](mailto:zhaoyang@sit.edu.cn)

## **WHEATFIELD—ACONFRONTATION: THE WORK OF AGNES DENES**

**BENHAM, KEVIN**

Associate Professor, an Assistant Professor, South Dakota State University

### **ABSTRACT**

*This paper explores the work of conceptual and land artist Agnes Denes (figure 1) with particular emphasis on her seminal work Wheatfield- A Confrontation. The narrative situates the work of Denes in the larger canon of Land Art including Walter De Maria, Robert Smithson, Michael Heizer, and Nancy Holt, while recognizing that Dene's work transits a wide range of art genres from conceptual work, installation, writings, poetry, philosophy, drawing and digital representation. Although Denes is little known outside the art world, her body of work has recently gained greater attention, thanks in part to a Guggenheim Fellowship she received in 2015.<sup>1</sup>*

*Her seminal work, Wheatfield- A Confrontation, was initially conceived in the latter part of the twentieth century and was first installed, in the early eighties, in Battery Park Landfill in downtown Manhattan. Since that first installation, the work has been installed repeatedly in other urban edges throughout the world, most recently in Milan, Italy.*

*This paper argues that Denes' work differentiates itself from other Land Art in some very important and innovative ways. First and foremost, the installation uses living material that is dependent on the geology, hydrology, biota and climatological conditions inherent on the given site. As a result, the soil conditions, existing pollutants, weather, and other factors affect the growth of the wheat in its various incarnations and the resulting harvest. While other land artists use organic material or plants in their works, Denes' work is imbued with special significance by the act of preparing soil, sowing seed, and harvesting the crop.*

*Additionally, the artist purposefully contextualized the work, not in a desolate and pristine environment, but rather at the rural/urban edge. The deployment of the work at the urban edge is a strategic decision that allows Denes to mine the political, geographic, and cultural history inherent on the site. This confrontation between these two spheres provides a conceptually rich piece that is amplified by the temporal quality of the work.*

### **1.1 Keywords**

Land Art, Conceptual Art, Narration, Culture

### **1 INTRODUCTION**

Along Over thirty years ago, while I was a sophomore at Kalamazoo College, a small liberal arts college in Western Michigan, I had the opportunity to participate in the New York Arts Program

<sup>1</sup> Hoban, Phoebe, *Works in Progress*, New York Times, May 15, 2015

The authors are solely responsible for the content of this technical presentation. The technical presentation does not necessarily reflect the official position of the Council of Educators in Landscape Architecture (CELA), and its printing and distribution does not constitute an endorsement of views which may be expressed. Technical presentations are not subject to the formal peer review process by CELA Track Chair System; therefore, they are not to be presented as peer-reviewed publications. Citation of this work should state that it is from a CELA conference paper. EXAMPLE: Author's Last Name, Initials. 2014. Title of Presentation. CELA Paper No. 14-xxxx. Baltimore, Maryland: CELA. For information about securing permission to reprint or reproduce a technical presentation, please contact CELA at [dsolco@uta.edu](mailto:dsolco@uta.edu) or 817-272-2321.

through the Great Lakes Colleges Association. As such, a group of students from small mid-western colleges were housed in a brownstone in Hell's Kitchen and for the semester we all worked in the arts. When we first arrived in New York we were all sent out on interviews to various working artists to determine whom we would work with for the semester. My very first interview was in SoHo in the loft occupied by Agnes Denes, a space that served as her residence and her art studio. She terrified me. I was a young Midwesterner who had been raised in a farming community with 500 people, so the city itself was overwhelming.

As I entered the studio, I was confronted with her conceptual piece, *Human Dust*, 1969. On a small pedestal sat a large glass bowl that held the calcareous human remains of a fellow artist who had passed. Above this vitrine was text that described in excruciating detail data regarding his food consumption, bowel movements, sex life, health, dreams and disappointments. Agnes hovered behind me noting how uncomfortable I was and in a seemingly disembodied voice exclaimed, "Most people think the text is a real person, but the real person is in the vitrine." For me, this was an unnerving start to a profoundly difficult interview.

During the interview, Agnes had the opportunity to describe her recently completed work, *Wheatfield-A Confrontation*. She was clearly excited about the work and it was also evident that it had provided a new trajectory for her life's journey. While I ultimately did not accept an internship with Agnes, and instead worked for a photorealist painter, the interview, while only an hour in the span of my life, left an indelible mark in my memory.

This past summer, I was sitting at my kitchen table on a Sunday morning pouring over the New York Times. As I was casually flipping through the Times Magazine, I happened across an article on older female artists whose careers were being rediscovered and reexamined. An accompanying photograph sent a chill down my spine. I recognized the loft that Agnes Denes had interviewed me in over thirty years ago. It was startlingly unchanged, as if the studio itself had been encased in a time capsule.

When I read the article, I was excited to learn that she had recently been awarded a Guggenheim Fellowship and I was also encouraged to learn that she had installed *Wheatfield-A Confrontation*

as a new installation at the outskirts of Milan, Italy this past summer. It felt both odd and comforting that an event that had happened for only a short period of time over thirty years ago, would again circle back to have an impact on my life. As a result, I have reconnected with Agnes after a span of thirty years and have had the opportunity to interview her regarding her work. This paper, about Denes, her work, and specifically Wheatfield is a result of that coincidence.



Figure 1 Adnes Denes.

Agnes Denes (*figure 1*) is a contemporary artist who, although little known outside the art world, has recently gained renewed attention for her body of work, thanks in part to a Guggenheim Fellowship she received in 2015.<sup>2</sup> Dene's work transits a wide range of art genres from conceptual work, installation, writings, poetry, philosophy, drawing and digital representation that is often esoteric and challenging. Although Denes does indeed work in a variety of media and across disciplines, it is her work in the realm of land art that is most interesting and the culmination and synthesis of her philosophy and methodology. In particular, her seminal work, *Wheatfield- A Confrontation* situates her as one of the most interesting forces in Land Art in the last century.

---

<sup>2</sup> Hoban, Phoebe, *Works in Progress*, New York Times, May 15, 2015



Agnes is one of the first females to be recognized within the canon of Land Art that includes such luminaries as Christo, Walter De Maria, Robert Smithson, Michael Heizer. Andy Goldsworthy and Mel Chin. While these men were making heroic works of art that were static, immutable and made mostly of inorganic materials, Denes was making equally heroic work out of living material that grows, changes form, is affected by geology and hydrology, is ephemeral, and eventually reproduces and dies.

Andy Goldsworthy, for instance, uses both inorganic and organic material in his work. When he does use organic material, he generally is using only a portion of plant material, produces his installations in remote areas, and those projects exist over a short period of time. In general, those installations are concerned mainly with ideas of form making, connective tissue, impermanence and entropy. The resulting works manifest themselves in their dispersal in photographic media and are not meant to be experienced in any corporeal manner.

Mel Chin, on the other hand, does indeed use living material in his works, but those installations are not necessarily concerned with an idea of planting, sowing, and harvest, but are rather a comment on our vanishing forests and the damaged environments we have inherited from our industrial past. Chin's seminal work, *Revival Field*, exists in isolation at Pig's Eye Landfill, a superfund site in St. Paul Minnesota. The installation is a hybrid between science and art and exists more as a testing field for hyper accumulating plants than a commentary on dwindling resources or a dissertation on the urban|rural condition.

Like Christo, Agnes' work has a political and philosophical edge, yet is easily accessible to the general public. In most places, particularly in the ubiquitous fields of the High Plains and Midwest, crops, in and of themselves carry no political polarization. It is Denes' insistence on installing her

work at the interstitial space of the urban|rural divide that gives a potency to the art and act of planting that would otherwise be absent in a traditional agrarian setting.

### The Genesis of Wheatfield

Denes' Wheatfield has its genesis in a much earlier work, *Rice/Tree/Burial* that was first realized in 1968 in Sullivan County, New York. Denes stated, "It was a symbolic *event* and announced my commitment to environmental issues and human concerns. It was also the first exercise in ecology."<sup>3</sup>

This particular work signaled a new beginning for Denes in that it was tied to the nascent conceptual art movement, yet still manifested itself in the visual realm. As such it was composed of three very distinct components: a buried piece of poetry, a group of chained trees, and a field of planted rice. The buried haiku poetry was "an act of renunciation....a pledge of rebirth and a new lifetime commitment as an artist dedicated to the future well being of the ecological, social, and cultural life on the Planet."<sup>4</sup> The chained group of trees embodied the idea of human interference, control of nature and the creative spirit of the human mind.

The third component, the rice field, had perhaps the most potency in its simplicity and acted as a precursor to her seminal work, *Wheatfield- A Confrontation*. In *Rice/Tree/Burial*, the planting of the rice in fallow land symbolized a universal substance of sustenance that had to be planted and nurtured. The ritual of preparing and sowing becomes an important component of the work. In

---

<sup>3</sup> Hartz, Jill and Denes, Agnes, *Agnes Denes*, Herbert F. Johnson Museum of Art, Cornell University, 1992, pg.106

<sup>4</sup> Mills, Dan and Heartney, Eleanor, *Agnes Denes Projects for Public Spaces: A Retrospective*, Samek Art Gallery, Bucknell University, 2003, pg.12

Rice|Tree|Burial, the seed itself symbolizes the genesis of the idea. It holds the initial life-giving element that through the act of germination and growth sets a process into motion.

It is this act of preparing the ground, sowing the seed, watching the grain grow, and ultimately its harvest that differentiates Denes' work from much of the other land art of the last century. Of those land artists who do use organic material, they often are either not planting the material as a component of their process, are only using a portion of the living material, or are working in remote locations.

This reassessment of her life's work by virtue of preparing the land, sowing the seed, and nurturing the grain in *Rice|Tree|Burial*, became the qualifying factor in determining the trajectory of her life in art. Her decision to plant a wheatfield in Manhattan instead of designing normative sculpture was a call to expose our misplaced priorities and deteriorating human values.

## Wheatfield



Figure 2.

The thirty-three square miles of land that compose Manhattan are one of the richest, most culturally powerful and most valuable parcels of land in the world. The conscious effort to plant, sustain and harvest wheat at the edge of this most urban condition was a powerful paradox that questioned existing expectations of a use for that valuable real estate.

For Denes, “*Wheatfield*, was a symbol, a universal concept. It represented food, energy, commerce, world trade, economics. It referred to mismanagement, waste, world hunger, and ecological concerns. It was an intrusion into the Citadel, a confrontation of high civilization. Then again, it was also a Shangri-La, a small paradise, one’s childhood, a hot summer afternoon in the country, peace, forgotten values, simple pleasures.”<sup>5</sup>

The two acres of wheat were planted in the Summer of 1982 at the foot of the World Trade Center only a block from Wall Street, the economic center of the world, facing the Statue of Liberty, a symbol of the country’s commitment to life, liberty and the justice for all (*figure 2*).



Figure 3

---

<sup>5</sup> From an interview with Agnes Denes, November 7, 2015

Wheatfield-Confrontation, situates itself in a much broader context that adds additional potency to its meaning. (*figure 3*) This wheatfield was different in that it wasn't located in the rich fertile farmland of the Midwest or the Plains, but rather in a post-industrial landfill bursting with rusted metal, boulder, old tires, furniture, old tires, coats, and other clothing. It was an extension of dense urban center with its skyscrapers, narrow streets, lack of daylight, pollution and traffic congestion.

Implicit in this installation is the act preparing the land and sowing the seed as a precursor to growth. In March 1982 over two hundred truckloads of landfill were dumped onto the site and then flattened with cultivating equipment. Following that initial preparation, an additional eighty truckloads of soil were dumped and flattened to provide the necessary topsoil for the germination and growth of the corn. Denes stated, "we maintained the field for four months, set up an irrigation system, weeded, cleared out wheat smut (a disease that had affected the entire field and wheat everywhere in the country). We put down fertilizers, cleared off rocks, boulders, and wires by hand, and sprayed against mildew fungus."<sup>6</sup>

Once the field was prepared, Denes and her two assistants began the work of planting the two acres of wheat in the shadow of the World Trade Center and Wall Street. This exercise in planting consisted of digging the furrows by hand, clearing any remaining rocks and garbage, and then sowing the seed by hand and covering the furrows with soil. The two acres required a total of 285 furrows and each of the furrows took approximately two to three hours to complete.

After the original incarnation of *Wheatfield: A Confrontation* in Battery Park, the project was repeatedly installed at other sites but Agnes readily admits, "there were small copies that had

---

<sup>6</sup> From an interview with Agnes Denes, November 7, 2015

nothing to do with the original *Wheatfield*, with its size and placement that created a powerful paradox and the calling to account, but they honored the intent.”<sup>7</sup>



Figure 4

While Agnes is appropriately critical of the copies created over the years, her installation in Milan, Italy in the summer of 2015 regains the potency of her original installation in Battery Park over thirty years ago and solidifies the importance of context in the manifestation and significance of the work. (*figure 4*)

From March to October 2015 The Fondazione Riccardo Catella, in partnership with the Fondazione Nicola Trussardi and Confagricoltura presented the installation of *Wheatfield: A*

---

<sup>7</sup> From an interview with Agnes Denes, November 7, 2015

*Confrontation*. In March the field was prepared and the seed sown in downtown Milan; more specifically in the Porta Nuova district. This area of Milan is an architecturally significant area of urban renewal that has reshaped the city skyline. This installation of *Wheatfield* is significantly similar to the original installation in Battery Park and was planted at a heroic scale. Over 12 acres (5 hectares) of land were planted as an agrarian installation in an area that will subsequently house a public park called the “Biblioteca degli Alberi”, or “Library of Trees.” In my interview with Denes she stated, “The Wheatfield of 12 acres this summer in Milan, Italy was calling attention to the misuse of land endangering animal habitats, world hunger, etc. etc. These fields call attention to so many issues that I am grateful when they let me create them.”<sup>8</sup>

Since its creation for the first time in 1982, *Wheatfield* as endured in public memory as one of the most famous earthworks of all time, a masterpiece imbued with symbolism and confrontational power. In it, nature reclaims the city through a simple, yet compellingly ecological image: a wheat field grows in the heart of New York City and again in the heart of Milan, Italy, both installations in the shadow of the city skyscrapers and both a powerful image in the daily lives of New Yorkers and the Milanese.

In my interview with Denes, she repeatedly commented on how thankful she is for the many people that have been supportive of her installations, have helped in their construction, preparation, and manifestation. Her work brings together a collective that binds people to a commitment that is much larger than the work itself. At the end of the interview, she alluded to additional work she intends to initiate as she nears the zenith of her career. She commented, “I have designed a forest

---

<sup>8</sup> From an interview with Agnes Denes, November 7, 2015

for New York City on the last open space and hope they won't stand in the way of it becoming a reality. It would be a magnificent addition to the city.”<sup>9</sup>

As landscape architecture makes a pendulum swing towards landscape urbanism, Denes' work situates itself at the Urban|Rural edge and reminds us that landscape is neither rural nor urban, but rather a continuum based on context.

#### References:

Denes, Agnes, Notes from an Interview with the Artist, November 7, 2015

Hartz, Jill and Denes, Anges, *Agnes Denes*, Herbert F. Johnson Museum of Art, Cornell University, 1992. pg. 106

Hoban, Phoebe, *Works in Progress*, New York Times, May 15, 2015

Mills, Dan and Heartney, Eleanor, *Agnes Denes Projects for Public Spaces: A Retrospective*, Samek Art Gallery, Bucknell University, 2003, pg. 12

#### BIO

Kevin Benham received his Master's Degree in Architecture from the University of Michigan and his Master's Degree in Landscape Architecture from Harvard University. Since that time, he has taught interdisciplinary studios in Architecture and Landscape Architecture at various institutions including the University of Michigan and Louisiana State University. He is currently an Assistant Professor of Landscape Architecture at South Dakota State University where his research is focused on Land Art and Installations. His creative activity currently includes several installations that are focused on observation, phenomena, and the temporal.

---

<sup>9</sup> From an Interview with Agnes Denes, November 7, 2015





COUNCIL OF EDUCATORS  
IN LANDSCAPE ARCHITECTURE

**A CELA Conference Presentation**

**Abstract ID: 175**

## **A LAWN AND ORDER – SPECIAL TREE VICTIMS UNIT: A SEMINAR ON PLANT ESTABLISHMENT AND MORTALITY**

**STEVENS, JULIE**

Assistant Professor in the Department of Landscape Architecture at Iowa State University

**KILES, JEFFERY**

Professor and Chair of the Department of Horticulture at Iowa State University

### **ABSTRACT**

*So-called “managed landscapes” are a complex blend of plants, organic and mineral groundcovers, and hardscape materials. When properly designed, installed, and maintained, managed landscapes provide economic and quality-of-life benefits for people and the environment. But the journey from concept to finished landscape is often fraught with challenges, frustrations, misconceptions, and ethical dilemmas leading to dead plants and undesirable landscapes. A major problem facing the profession is the gap existing between the designer’s intentions and the reality of implementation and maintenance. This gap results in unacceptably high rates of plant mortality sometimes within a year of installation, with increasing mortality over time, resulting in millions of dollars lost in materials and in unrealized values. There are many possible causes of mortality, including: improper specification of plants, growing practices that lead to root girdling, installation in undersized planting areas and/or highly compacted soils, adverse environmental conditions, and inadequate post-installation maintenance.*

*However, we can create functional, sustainable, and beautiful landscapes when abiotic and biotic stresses are alleviated via a continuum of practices that begin with thoughtful design and science-based installation and maintenance. To examine the problems of site design and plant mortality, the authors created a seminar in Plant Forensics. This course brought together students from two departments—Horticulture and Landscape Architecture—to examine the critical relationship between plant health and establishment and current design and installation practices. A major goal of the seminar was to use site investigations to spark discourse among students, faculty, and guest practitioners.*

*The course’s weekly format involved a 50-minute lecture/discussion and a three-hour site visit led by local designers, horticulturists, contractors, facility maintenance personnel, and nursery professionals. Students were expected to analyze and critique readings and presentations and develop their own understandings through independent projects, such as the “Forensic File”, a semester-long compendium, in which students captured personal reflections and knowledge that would be useful in their future professional careers.*

*The seminar successfully activated participants’ concerns about plant health; this was evidenced by the passionate class discussions. However, the instructors speculate about how this course can have larger impacts. Can this pedagogical strategy influence the students as practitioners? Will participating students be able to influence their future employers? This presentation will reflect on these questions, discuss lessons learned, and propose future ways of addressing plant mortality both in and out of the classroom.*

---

The authors are solely responsible for the content of this technical presentation. The technical presentation does not necessarily reflect the official position of the Council of Educators in Landscape Architecture (CELA), and its printing and distribution does not constitute an endorsement of views which may be expressed. Technical presentations are not subject to the formal peer review process by CELA Track Chair System; therefore, they are not to be presented as peer-reviewed publications. Citation of this work should state that it is from a CELA conference paper. EXAMPLE: Author’s Last Name, Initials. 2014. Title of Presentation. CELA Paper No. 14-xxxx. Baltimore, Maryland: CELA. For information about securing permission to reprint or reproduce a technical presentation, please contact CELA at [dsolco@uta.edu](mailto:dsolco@uta.edu) or 817-272-2321.

**1.1 Keywords**  
Plant Health, Urban Trees, Pedagogy

**1 PREMISE AND PURPOSE OF THE COURSE**

This paper is intended to review the purpose, content and structure for a multidisciplinary course called Plant Forensics. The course was developed after many conversations among faculty and practitioners in the fields of horticulture and landscape architecture concerning the high rates of plant mortality in the built environment. The co-authors, representing these two disciplines, joined forces to explore this discouraging and costly issue together through a multidisciplinary seminar course. Local professionals from both horticulture and landscape architecture endorsed the premise of the course, indicating a desire to change the trajectory of plant establishment in the landscape. This paper considers the need for attention to this matter, describes the course content and structure and provides some lessons learned so that it may be replicated.

Horticulture and Landscape Architecture are related but distinct disciplines. According to the Iowa State University department of Horticulture, “Horticulturists grow fresh fruits and vegetables, plan and create beautiful landscapes, cultivate and maintain acres of turfgrass for recreation and function, and breed new plants for pest resistance and environmental tolerance...” (hort.iastate.edu) According to the Bureau of Labor Statistics, “Landscape architects design parks and the outdoor spaces of campuses, recreational facilities, private homes, and other open areas.” (bls.gov) With greater understanding and communication between disciplines, we can change this trajectory of unsuccessful plant establishment and impact future generations with thriving urban tree canopies.

**2 THE PROBLEM: TOO MANY FAILURES IN PLANT ESTABLISHMENT**

This course focused on the process involved in plant establishment and considered the points at which our respective professions interact in order to address why we are experiencing

such a high plant mortality rate within the first few years of landscape establishment. Figure A illustrates the phases for establishing new plants in the landscape and the various factors that lead to either success or failure of managed landscapes. For example, in the plant specification phase, many written and graphic documents call for balled-and-burlapped trees to be planted so that the top of the rootball is level with the surrounding grade. Several issues may ensue with this simple (yet commonplace) specification error: one, trunk flare and accompanying roots may be buried several inches below the top of the rootball due to faulty nursery practices; two, the soil on site may be so poorly drained that roots will sit in saturated soil conditions. Ultimately the tree will languish or die, leaving the client with the burden of replacement cost. A proper specification would take into consideration the soil conditions (requiring soil tests) and would be written based on proper factors such as the depth of the trunk flare rather than the soil surrounding the root ball.

Figure A: Plant Establishment Process: Common Problems and Solutions

Nursery Production		Design		Plant Selection		Specification	
Common Problems	Solutions	Common Problems	Solutions	Common Problems	Solutions	Common Problems	Solutions
<ul style="list-style-type: none"> <li>-Poorly developed roots</li> <li>-Girdling roots</li> <li>-Damaged roots</li> <li>-Poorly formed or damaged rootballs</li> <li>-Poorly developed branching structure</li> <li>-Mechanical damage</li> </ul>	<ul style="list-style-type: none"> <li>-Invest time to stay current on proper nursery techniques</li> <li>-Train employees to handle and care for plants properly</li> <li>-Train employees to minimize damage</li> </ul>	<ul style="list-style-type: none"> <li>-Plants are overcrowded</li> <li>-Too little species diversity</li> </ul>	<ul style="list-style-type: none"> <li>-Understand the requirements of each species</li> <li>-Increase species diversity to eliminate large amounts of loss when a disease or insect impacts a species (like Emerald Ash Borer)</li> </ul>	<ul style="list-style-type: none"> <li>Plants not suited for: <ul style="list-style-type: none"> <li>-the zone or microclimate</li> <li>-soil composition</li> <li>-soil compaction</li> <li>-water availability</li> <li>-soil saturation</li> <li>-pollution</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>-Understand the needs of the plant both above- and below- ground</li> <li>-Invest in site and soil preparation</li> <li>-Expand your plant palette</li> </ul>	<ul style="list-style-type: none"> <li>Call for improper planting methods such as: <ul style="list-style-type: none"> <li>-Too deep</li> <li>-Too shallow</li> <li>-Improper staking</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>-Take time to learn about proper planting methods and revise planting specifications accordingly</li> <li>-Base specifications on site and soil conditions</li> </ul>

Plant Sourcing		Installation		Maintenance	
Common Problems	Solutions	Common Problems	Solutions	Common Problems	Solutions
<ul style="list-style-type: none"> <li>-Poor quality plants are sourced</li> <li>-Poor quality plants are not rejected</li> <li>-Plants are not properly transported to the site</li> </ul>	<ul style="list-style-type: none"> <li>-Tour nurseries and pick out plants when possible</li> <li>-Only source plants from reputable nurseries</li> <li>-Reject any plant that is of poor quality</li> <li>-Reject damaged plants</li> </ul>	<ul style="list-style-type: none"> <li>-Damage occurs during unloading, placing or planting</li> <li>-Plants are not properly cared for upon arrival</li> <li>-Planting is too deep or too shallow</li> <li>-Roots are damaged</li> </ul>	<ul style="list-style-type: none"> <li>-Hire reputable installation companies who understand how to handle, plant and care for plants during installation</li> <li>-Visit the site often and reject poorly planted and maintained plants</li> </ul>	<ul style="list-style-type: none"> <li>-Improper Watering</li> <li>-Mechanical damage</li> <li>-Improper or no corrective pruning</li> <li>-Unnecessary stress and damage</li> </ul>	<ul style="list-style-type: none"> <li>-Provide clients with a maintenance plan</li> <li>-Hire reputable maintenance companies who understand proper care and pruning techniques</li> <li>-Provide tree protection mechanisms</li> </ul>

### 3 SETTING THE STAGE

Why are errors like this taking place so often? What is keeping our respective professions from achieving successful plant establishment in the landscape? First, we will examine what makes a successful managed landscape.

#### What makes a successful managed landscape?

Successful landscapes are sustainable and contribute positively to local ecosystem services. “The term “ecosystem services” describes the goods and services provided by healthy ecosystems—the pollination of crops by bees, bats, or birds, for example, or the flood protection provided by wetlands, or the filtration of air and water by vegetation and soils.”

([sustainablesites.org](https://sustainablesites.org)) Trees contribute to environmental and human health and well being by

mitigating pollutants in our air, water and soils and providing buffers for noise, wind, sun and undesirable views. The landscape can provide food and medicine, support local culture and placemaking, and bring nature into urban environments. When designed and maintained properly, the landscape can provide therapeutic benefits and make the places we live, work and play beautiful. It is critical that landscape improvements be economically viable both in terms of upfront costs and long-term maintenance. "Sustainability" means all of these factors are achievable and balanced for long-term plant and landscape success.

### **Factors Leading To An Unsuccessful Landscape**

It is important to understand factors affecting plant health. These factors account for the majority of the content covered in this class and can be divided into three sections; biotic stresses, abiotic stresses and process failures. "Biotic plant problems are caused by living organisms, such as fungi, bacteria, viruses, nematodes, insects, mites, and animals. Abiotic disorders are caused by nonliving factors, such as drought stress, sun scald, freeze injury, wind injury, chemical drift, nutrient deficiency, or improper cultural practices, such as overwatering or planting too deep." (Flynn, 2003) Process failures are those related to human error through the design, installation and maintenance processes. It is possible that more than one factor may contribute to plant decline or mortality.

### **Biotic (living factors)**

Biotic factors or stressors come in many forms. Some, like the pathogens causing Dutch elm disease (or more recently, the emerald ash borer), sweep across large regions causing devastating aesthetic and economic loss. Other biotic stressors are better characterized as

nuisance problems that can be avoided. For example, the best way to combat the fungal pathogen causing apple scab is to plant scab-resistance crabapples. It is incumbent upon horticulturists and landscape architects to become intimately familiar with their plant palettes, know where these plants are best used in the landscape, and perhaps most importantly, avoid those species/cultivars with debilitating biotic problems. We should never saddle the end user or landscape maintenance professional with extra maintenance resulting from poor plant material choices. The best way to avoid biotic problems in the managed landscape always begins with choosing appropriate and healthy plant material.

### **Abiotic (non-living factors)**

There is a wide range of abiotic stresses that affect plant health. One of the most common stressors, mechanical damage, can appear anywhere along the continuum from growing to establishing landscape plants. Plants can be exposed to mechanical damage if they are field-grown and transplanted using a tree spade, transported carelessly to the site or nursery, or installed with mechanical devices (such as skid loaders) without necessary precautions to prevent damage. Installed plants are repeatedly subject to damage from lawn mowers, street cleaners and snow-removal equipment. Root compaction from foot and vehicular traffic can lead to a long-slow death and can be prevented with budgeting and forethought.

Every landscape plan should include tree protection mechanisms; these can be controversial and clients may find it difficult to justify the extra costs but it is worth advocating for some level of protection, especially in high-traffic areas. The least expensive method for root and trunk protection from mower damage is to maintain a proper mulch ring around trees planted in lawn areas. In most cases a 5-6' diameter tree ring is sufficient, but only if the rings are

maintained over time. Urban trees can benefit greatly from tree grates or tree guards. Tree grates are fairly common in street tree plantings, but these can cause girdling if the opening of the grate is not expanded as the tree grows. City maintenance professionals often cite tree guards as more of a frustration than a benefit for some of the very reasons tree advocates promote them. They find it difficult to clean the sidewalks of snow and debris and do not want the extra maintenance of repairing or replacing damaged guards. They do prevent soil compaction and mechanical damage from snowplows and street sweepers. Many cities have tree-protection guidelines and may issue fines when unnecessary damage occurs to a tree on city property.

Site and climate conditions account for the majority of other abiotic stresses. These include sun and wind exposure, poor soil and water conditions, space restrictions and overcrowding, extreme weather changes such as droughts or floods and misjudgments in plant hardiness. Many of these potential stresses can be eliminated in the design and plant selection phases, requiring landscape architects and landscape designers to understand the environmental and spatial requirements for each species as well as their appropriateness for a myriad of sites. These topics of plant culture are introduced in several plants-related courses but are best learned through repeat experience. Plant spacing can also lead to stress for many plant species; overcrowding seems to result from a misunderstanding of the needs of a plant or a desire for a mature looking landscape in a short amount of time. The ‘copy and paste’ function in computer-aided design may also be to blame for other overcrowding issues; while it has allowed designers to work more efficiently, it has also apparently obviated thoughtful detailing for successful planting design.

## **Process Failures**

Biotic and abiotic stresses aside, failures throughout the process of establishing plants in the landscape are by far the greatest issues of concern. To overcome this problem, the first step is to acknowledge limitations within the current process. The first limitation is a lack of knowledge about the factors affecting plant health and current practices developed through science and technology that would alleviate high rates of mortality. Other process failures include timing issues, poor communication, a lack of post occupancy evaluations, projects with insufficient budgets, dilemmas involving requirements and regulations and immediate and long-term maintenance concerns.

## **4 LIMITATIONS**

### **Knowledge**

How do we educate landscape architects, horticulturists and allied disciplines about factors affecting plant health? How do we stay current on installation and maintenance techniques and associated stresses? What information would lead to more successfully established plants?

One of the most common and least successful planting components of the urban environment is the street tree. The typical street tree planting detail provides each tree with approximately 120 cubic feet of planting medium. The planting medium is often poorly drained, highly compacted and low in organic matter. It is a commonplace to witness a tree planted in a hole along with varying amounts of construction debris. Even if the tree is perfectly healthy prior to planting, in this case it has been given a less-than-optimal chance at long-term survival.

The best chance for reforming current plant establishment practices is to first acknowledge that current practices are deficient, and then to develop and understand successful



alternatives for practice. What does this tree require from its growing environment? It depends on the tree, but in general it needs healthy soil, plenty of space to mature both above- and below-ground, an appropriate amount of water and some degree of protection from mechanical injury.

The urban environment scarcely mirrors the environment where trees originally came from; which requires assistance from science and technology to create a successful growing situation. New technologies to assist plant establishment seem more readily available today, but many can be cost-prohibitive given the typically low budgets assigned to landscape improvements. It is important to stay current on trends and issues through trade and scientific literature and continuing education opportunities, but also important to rely upon experts such as arborists who can assess conditions for tree health in particular environmental circumstances. Budgeting for a certified arborist on projects involving existing trees could be money well spent.

## **Time And Timing**

There are two issues with time: the point at which professionals are brought into a project and the timeline for completion. A tight turn-around time for either the design or installation can lead to oversights in plant selection and specification; such constraints can inhibit creativity and attention to detail. When time is an issue, designers often turn to pre-existing design and specification standards that may not be appropriate for the site.

All too often, designers and horticulturists are hired as a consultant or to design a planting plan after the planting spaces have been determined by an architect or engineer. In this case, it may be difficult to influence the specifications or make changes to planting spaces, but it is important to advocate for the best possible solution. If we use the typical street tree as an example, it is apparent that architects and engineers are likely following specifications that they

have used for years and are not aware of concerns for the longevity of the tree. These allied professions also need to understand the challenges involved in plant establishment; landscape architects and horticulturalists can advocate and provide necessary justification for shifts in industry standards.

### **Evaluation is Essential**

It is essential to visit sites often during the construction and planting phases in order to insure that properly written specifications are being followed both above and below ground. These visits should be factored into the overall cost of the project, a line item many find difficult to justify when working with insufficient budgets. Frequent site visits may save time and money in the long run if potentially fatal mistakes are caught and corrected.

Post occupancy evaluations allow for time to evaluate a site and to reevaluate ones work so designers are less likely to make the same mistakes repeatedly. It is best to visit the site immediately after construction is complete and thereafter at regular intervals over the next few years. During these visits it is important to consider the following questions: what percentage of plant mortality is present on the site? What percentage is acceptable? What plants appear to be thriving and why? Is the lack of success traceable to poor species selection, impossible site conditions, poor quality plant material, or all of the above? Which plants are dead or declining and why? What signs of stress are present and can the cause be determined? Is the plant likely to overcome these stresses or should it be removed? Can conditions, whether good or bad, be linked to specific nurseries or construction companies?

## **Communication**

Open and frequent communication throughout the process may be one of the most important but challenging and time-consuming aspects of establishing new plants in the landscape. One contributing factor is the complicated contracting process on a typical project. In some cases a designer may be hired by the owner but in others the designer will be hired by a general contractor, an architect, or an engineer. Ideally the designer has the opportunity to communicate with each of these professionals throughout the process, ensuring communication is taking place and everyone is in agreement. Furthermore, communication is the only way to educate clients and contractors about the value of the landscape and advocate for proper planning which may mean increasing the budget. It is also important to learn the language of those involved in the project. For example, it is not necessary to understand all the ins and outs of irrigation systems, but the designer should know and understand essentials of irrigation design and maintenance in order to collaborate effectively with an irrigation professional.

## **Budgets and Values**

Landscape budgets can range from a low budget to meet minimum city requirements or an above-average range for a more comprehensive approach to the landscape. In many cases, budgets are based on a certain percentage of the cost of a building or total project. Clients may also consult with professionals who can determine a budget range based on past experience with projects of similar size and scope. There are concerns with this process, for one, if minimum tree counts are the basis of the budget without considering alterations to the site such as soil tests and modifications. The larger question is about the value that clients, contractors and city planners place on the landscape.

Ideally, the allocation of funds would be balanced to reflect the needs of the plants based on factors such as soil quality, the quantity of plants, design intent for planting, and both short- and long-term maintenance needs. Some contemporary projects are requiring that funds be set aside upfront to ensure long-term maintenance of a site.

## **Requirements and Regulations**

One could argue that city, county and state codes dictating minimum vegetation standards have led to an increase in the number of urban trees planted today. However, these regulations have their unintended consequences. Many clients or general contractors are only concerned with meeting legal requirements and so hastily design, specify, and install the required plants without proper care and attention given to the site conditions, the quality of the plant material, proper planting techniques, and to post-construction care.

The low-bid process for public projects is another issue that requires attention and meaningful discussion amongst professionals. Low-bid rules intend to ensure that money (often tax-payer dollars) is well-spent and seek to prevent the potential for favoritism between clients and bidders. However the process is plagued with problems, not the least of which is the countless and costly change orders that become necessary when the awarded contractor realizes that they cannot complete the project at the agreed-upon price. In order to make the lowest bid, compromises are made in the form of poor plant material, inappropriate installation techniques and shortcuts in site preparation such as alterations to the soil.

In situations such as these, it is not uncommon to see problems almost immediately such as plant desiccation prior to installation, plants positioned too deep or too shallow, wire cages and

burlap left on the rootball, mechanical damage and even improperly secured plants leaning in the hole.

In order to address these problems, many municipalities are requesting more flexibility in the bid process with regard to contractor qualifications or performance standards. In some situations, the agency awarding the bid can choose from among the three lowest bids or establish evaluation criteria that allows consideration of factors other than price. Properly managed, this process can be fair and transparent, and may result in a more successful project and a thriving landscape.

## **Maintenance**

Nearly every client, regardless of project scale, requests a low-maintenance landscape. While it's true that not every landscape will require the attention of a botanical garden, it is also true that every landscape will require some ongoing maintenance. It is essential that landscape architects and horticulturists educate our clients about maintenance, and help them budget for proper long-term maintenance needs. Clients should not be expected to understand what plants require, so designers need to provide them with information and a maintenance plan. Just as we provide construction documents with planting details and specifications, we also need to provide maintenance plans for each project. Here again is where the respective design disciplines are obliged to cooperate. Landscape architects are not formally taught about maintenance, but horticulturists are exposed to the concept from the early days of their training. In some cases it may be in the best interests of a design firm to hire a horticulturist to create these maintenance plans, complete with an annual budget range. In some cases the company installing the plant

material may also be an appropriate selection for long-term maintenance; in others, the client may need to spend some time reviewing the capabilities of potential maintenance companies.

## **5 COURSE STRUCTURE AND LESSONS LEARNED**

In this section we will describe the structure of the course, changes made between year one and two, and additional alterations we plan to make in the future. Some of these changes derive from faculty observations and reflections, and some derive from student feedback.

This three-credit course was structured around lectures, labs, guest lectures and site visits. Class was held on Tuesdays from 12:40-1:30 and Thursdays from 12:40-4:30. Tuesdays were designated for lectures and in-class activities or labs that fit into a 50-minute block. The extended Thursday afternoon class period afforded us some flexibility for guest lectures and site visits. This structure was developed after teaching this course the for first time in the spring of 2014 when we realized travel beyond the city limits was impossible unless additional time was given to lab periods. This arrangement provided us with 30-60 minutes of travel time in each direction and the remaining time for site visits. Additionally, we determined that the course would be more effective in the fall semester when weather is more favorable.

Students were evaluated on the following point system:

- Reflections and Essays 150
- Group Discussion 100
- Forensic File Project 200
- Participation, Engagement, Growth, Leadership 50
- Total Points 500

Students were evaluated on assignments, projects and their engagement in class activities. Each week, they were required to submit either a reflection from site visits and lectures and/or report on a current event or research report pertaining to the topic of the class. Two longer projects spanned most of the semester: the Plant Forensic File and the Planting Specifications Project. These are described in the sections below.

### **Co-Teaching**

Teaching duties were shared between instructors by content and logistics. Figure B shows the course schedule for the semester. The topics follow the general flow of the process for establishing plant material in the landscape; the topics column indicates the faculty member responsible for preparing lectures and activities for the week. We divided up the site visits and guest lectures based on personal connections with practitioners. Despite our attempts to solidify a schedule prior to the beginning of the semester, many changes took place due to scheduling conflicts with practitioners. As changes occurred, students were made aware via email and through in class announcements and the calendar was updated and redistributed periodically. Figure B is the fourth iteration.

**Figure B: Plant Forensics | Fall 2015 | Weekly Schedule – (Subject to Change)**

<i>Week</i>		<i>Topic</i>	<i>Assignments</i>	<i>Adventures</i>
	<b>August</b>			
1	25,27	Roles of the Profession, Dynamic and Complicated Landscapes (Iles and Stevens)	Weekly Reflection and/or Current Event Due Tues	Campus Walk
	<b>September</b>			
2	1,3	The Nursery Industry (Iles)	Weekly Reflection and/or Current Event Due Tues	Iowa Native Trees and Shrubs Nursery (Site Visit)
3	8,10	Biotic and Abiotic Factors Affecting Plant Health (Iles)	Weekly Reflection and/or Current Event Due Tues	Iowa State University Facilities (Guest Lecture)
4	15,17	Designing with Plants (Stevens)	Weekly Reflection and/or Current Event Due Tues	Sommerset Development (Site Visit)
5	22,24	Selecting Plants (Stevens)	Weekly Reflection and/or Current Event Due Tues 1 <sup>st</sup> Draft Forensic File Due Thur	Nolan Plaza with David Jahn, Des Moines City Forester (Site Visit)
6	29,1	Proper Planting Techniques (Iles)	Weekly Reflection and/or Current Event Due Tues	Rennebohm Landscape Architecture (Site Visit)
	<b>October</b>			
7	6,8	Maintenance – Post Planting (Iles and Stevens)	Weekly Reflection and/or Current Event Due Tues Tree Planting on campus	Horticulture Research Station (Site Visit)
8	13,15	Maintenance – Pruning (Iles)		Des Moines Botanical Center (Site Visit)
9	20,22	Mature Landscapes Safety and Hazard Trees (Iles)	Midsemester evaluations due	Ames City Parks (Site Visit)
10	27,29	Plant Specifications: Intro and Evaluation (Stevens)	2 <sup>nd</sup> Draft Forensic File Due Assign Planting Specs Thur	Iowa ASLA Fall Conference
	<b>November</b>			
11	3,5	Plant Performance (Iles and Stevens)	Weekly Reflection and/or Current Event Due Tues	Country Landscapes (Site Visit)
12	10,12	Plant Technology (Iles and Stevens)	Weekly Reflection and/or Current Event Due Tues Review Planting specs Thur	RDG Planning and Design (Guest Lecture)
13	17,19	Client Relations (Stevens)	Weekly Reflection and/or Current Event Due Tues Draft Planting Specs due Tues	Confluence Landscape Architecture (Guest Lecture)
	24,26	THANKSGIVING BREAK	None	None
	<b>December</b>			
14	1,3	Putting it all together (Iles and Stevens)	Weekly Reflection and/or Current Event Due Tues	Genus Landscape Architecture (Guest Lecture)
15	8,10	Wrap Up (Iles and Stevens)	Final Planting Specs Due Tues Forensic Files Due on Thur	
16	15,17	FINALS WEEK	Reflection Activity in class	

## Lectures and Labs

The first order of business on most Tuesday's was a "pair and share" activity where students were instructed to turn to a partner and share their reflections, current events and research reports with another member of the class. After taking several minutes to converse we asked two volunteers to share their report or reflection with the class. The activity only consumed about 10 minutes and has multiple benefits: it allows students to relate across disciplines and it created a sense of accountability for engaging class content in a more self-directed manner. In the future, we will integrate this activity into every Tuesday class period for these reasons and because the students indicated that they benefited from this activity.



Lectures and lab activities generally followed the topic of the week and became the responsibility of the faculty member with the greatest expertise in the area. In some cases we shared the topic in order to present different perspectives. We planned to keep the lectures to 20 minutes, leaving time for discussion and in-class activities such as identifying biotic stresses on plant samples. Some of the more effective in class activities included plant stress diagnosis and budgeting exercises. For the plant stress diagnosis class period, faculty collected samples of plants showing various biotic stress symptoms. Students worked in small teams to identify the species of each sample, review the symptoms and make a diagnosis. The budgeting exercise presented students with a small commercial landscape project and minimum city requirements for trees and shrubs. Again, working in small teams, students were given prices for plants and materials and asked to generate a simple design and budget. During the next class period, each team presented their approach and budget. We then revealed the actual project budget and discussed the dilemmas they will face as professionals, especially with regard to proper site and soil preparation. It should be noted that all teams represented by students from both horticulture and landscape architecture.

### **Site Visits and Guest Lectures**

We tried to schedule a representative and diverse cross-section of practitioners for site visits and guest lectures from our respective professions. Proximity to plant nurseries posed challenges within the four-hour lab time and in the future we will schedule an all-day or overnight trip in order to see some of the larger plant nurseries in the region. Many of our trips were to Des Moines, our state capital with a population around 600,000 including the metropolitan area. In most cases, the design firm giving the tour determined the sites we visited.

We also visited a couple of recently renovated civic projects allowing us to engage a wider cross-section of practitioners. Most practitioners were willing to have candid conversations about project challenges and why certain aspects failed. The students were encouraged to ask tough, yet respectful, questions and talk with people using the spaces we visited. Student reflections indicated the need for more in class discussions following a site visit in order to discuss topics that they were uncomfortable bringing up with the guest practitioner.

The majority of our guest lecturers presented projects and perspectives related to the course content. We prepared them ahead of time for the specific focus of the week and chose guests who we felt could speak best to the topic. On occasion, presenters veered from the topic and lost the interest of the students. In the future we will rely less on email communication and instead schedule a phone call with practitioners to make sure learning objectives for the day are clear and obtainable. Weather is an unpredictable factor in the Midwest. As Figure B illustrates, indoor guest lectures were scheduled en lieu of site visits near the end of the semester when Iowa weather typically poses challenges to travel and comfort.

## **Projects and Assignments**

Creating and conveying appropriate projects and assignments proved to be one of the more challenging aspects of the course. Upon reflection we think there are a couple of reasons for this: one, it is an upper-level course and at this stage of their academic career, students from horticulture and landscape architecture have developed divergent styles and expectations about class projects. Additionally, some students are understandably distracted as they prepare for graduation. There is also a struggle between faculty and students in terms of an appropriate

amount of direction given and perceived. We will describe the major projects and review how these factors have revealed themselves through student feedback.

In year one, the major project for the semester was a case study of a locally built landscape. The students worked in multidisciplinary teams and used the Case Study Method created by Mark Francis for the Landscape Architecture Foundation ([lafoundation.org](http://lafoundation.org)). Throughout the semester they addressed pieces of the method as it related to the weekly topic. They spent time with the design firm and when possible, the owner of the site. They were given a fair bit of flexibility but had regular check points when faculty would review their work and provide feedback. This was probably more successful than we realized but some comments from the students indicated that it was daunting at times and seemed to go on forever. Overall, the students seemed to enjoy the opportunity to engage one-on-one with professionals and really get to know the details of a specific project.

In year two we opted to forgo the Case Study project for a semester-long project whereby students were to create a compendium of information related to Plant Forensics. The idea behind this project was to encourage students to create a resource that they could use in their professional careers since there are few references to help guide some of the decisions we face throughout the process of establishing plants in the landscape. Students were expected to contribute to this compendium each week including content covered during class.

The Forensic File was expected to have the following components: readings, current events, site investigations, site plan evaluation, and planting specifications. We placed great emphasis on independent site investigations and reflections, encouraging students to have at least one of each per week. A project statement was provided to the students during the first day of class, describing the goals and requirements of the projects. After reviewing student feedback, we

discovered a stark contrast between the disciplines: the horticulture students were frustrated by the amount flexibility and the landscape architecture students appreciated the ability to customize this resource based on their interests. The level of flexibility given was intentional on the part of the faculty who wished to encourage students to become more self-driven and take ownership over independent work. We reviewed their Forensic Files twice during the semester and again at the end. Near the end of the semester, the horticulture students began asking for a rubric and we supplied one but it was not as prescriptive as some students had desired. While the majority of the class was comfortable with the level of detail given in the project statement, several frustrated students wanted to know exact numbers of entries required in every category and word counts for site investigations and reflections. It is our belief this level of explanation is unnecessary and inappropriate for a 400 level class. Is this a reflection of the millennial generation? Where does this expectation come from and why are students reluctant to take ownership over their work?

The Planting Specification Project was the second significant project of the semester. We started the project in week ten, giving student teams five weeks to work through the requirements. The first step was to evaluate a number of planting specifications, with identifying information removed, from a variety of landscape architecture firms. The multidisciplinary teams spent time in and out of class evaluating the specifications for errors and omissions. We then used a class period to review the specs, allowing both students and faculty to share their critiques. Student teams then drafted their own set of planting specifications complete with drawings, notes and a written document. They were allowed to begin with the Statewide Urban Design and Specification (SUDAS) manual created by The Institute for Transportation at Iowa State University ([iowasudas.org](http://iowasudas.org)). This manual provided a basic outline and minimum standards from

which to build. Horticulture students were encouraged to share their knowledge about proper planting, handling and care techniques while the landscape architecture students shared their understanding of construction documents and computer-aided drafting. Some of the horticulture students reported concerns about the relevance of this project for their career development but the landscape architecture students reported a greater understanding for the content, though at times it was daunting to review the written specifications. This project fills a gap in our current education model—while construction documents are covered in the landscape architecture curriculum, planting specs receive a minimal amount of attention and detail. Will the students be prepared to challenge and revise the planting specifications used in their future place of employment?

### **Reflections: The Ideal Project**

The next time we teach this course, we will attempt another semester long multidisciplinary team project. This approach combines the most successful aspects of the Case Study and Forensic File projects together. Much like the case study project student teams will be assigned an actual site at the beginning of the semester; they will have several sites to choose from resulting in a range of projects and perspectives. The idea of this project is to walk them through the entire process of establishing plants in the landscape (see Figure A). They will learn about the nursery industry and various methods and challenges of growing, transporting and maintaining plants. They will then design the site, determine appropriate site and soil alterations, create a budget, source plants, and write their own planting specifications and a maintenance plan. Throughout the process, they will have contact with the design firm responsible for the site and, if possible, the owner and other associated contractors. Student teams will be expected to

present their work to their peers, faculty and guest reviewers at the end of each phase. Ideally these sites should have been recently constructed and within an hour's drive allowing students to evaluate the actual process and the health of the plant material upon arrival, as well as during and after installation. At the end of the semester, students would put together a comprehensive project book and presentation to bring it all together.

## **6      IMPACTS**

It is premature and perhaps unrealistic to gage the effectiveness of this course and impact it might have on the professional development of this subset of students. But we do feel the course has merit and is worth continuing, albeit in a slightly revised form. It will be interesting to see how the course impacts the way students practice and interact with other disciplines involved in the project. It is the hope of the instructors that they become more understanding of the challenges others face in their respective roles and have the knowledge and answers they need in order to have influence over the standard operating procedures in their workplace. Though it may be difficult as a new associate, we hope that the students who have completed this course will not succumb to the pressures of the fast-paced workplace and surrender to status quo but rather be advocates for taking the necessary steps to ensure proper plant establishment in the built landscape.

## 7 REFERENCES

Bureau of Labor Statistics:

<http://www.bls.gov/ooh/architecture-and-engineering/landscape-architects.htm>

Flynn, Paula. "Diagnosing Tree Problems." Iowa State University, Extension Publication. IC-489(22) -- September 12, 2003

Landscape Architecture Foundation: <https://lafoundation.org/research/case-study-method/>

Iowa State University Department of Horticulture: <http://www.hort.iastate.edu>

Iowa State Wide Urban Design and Specification: <http://www.iowasudas.org>

Sustainable Sites Initiative: <http://www.sustainablesites.org>

### BIO

Julie Stevens is an Assistant Professor in the Department of Landscape Architecture at Iowa State University where she teaches design studios and courses related to plant identification, planting design and the relationships between plants and people. Prof. Stevens has directed a design-build program at the Iowa Correctional Institution for Women since 2011 and is a founder and current co-chair of the Environmental Justice Professional Practice Network for the American Society of Landscape Architecture. Prof. Stevens received a B.S. in Horticulture from Iowa State University and an M.L.A. from the University of Oregon.

Jeff serves as Professor and Chair of the Department of Horticulture at Iowa State University (Ames, IA). He teaches, conducts applied research, and provides Extension programming in the areas of landscape plant establishment and maintenance, woody plant evaluation, and nursery and garden center management. He received his B.S., M.S. and Ph.D. degrees in horticulture from Michigan State, Penn State, and Iowa State, respectively. Between degrees, Jeff worked in the retail garden center segment of the green industry, first in suburban Detroit, Michigan, and later in Littleton, Colorado.



COUNCIL OF EDUCATORS  
IN LANDSCAPE ARCHITECTURE

*A CELA Conference Presentation*

**Abstract ID:**

## **USING InVEST TO EVALUATE THE PERFORMANCE OF URBAN GROWTH MANAGEMENT STRATEGIES IN CONSERVING ECOSYSTEM SERVICES IN THE URBAN FRINGE AREAS OF THE CITY OF CORVALLIS, OR**

**ZHOU, LONG**

PhD Student, University of Oklahoma

### **ABSTRACT**

*The world is undergoing a sustained wave of urbanization and through changing land use and land cover, urbanization has been posing threats to “eco-environments” at various scales (Wang et al 2002). Urban growth management strategies have been widely applied at both local and regional scales in the United States to control urban growth and conserve natural resources (Bengston et al 2003). Scholars have studied the performance of Urban Growth Management in environmental conservation, while the results vary due to different scales and research perspectives (Frenkel, 2004; Nelson 1992; Gordon, et al, 2009; Cathcart, et al 2006; Robinson, et al 2005; Kline and Alig, 1999). Through reviewing relevant literature, the author found that few studies explore this issue based on ecosystem service quantification, which could directly act as an indicator of the extent of environmental conservation under different planning policies (Heldal and Baszka 2012).*

*The InVEST (Integrated Value of Ecosystem Services Tradeoffs) modeling program developed by the Natural Capital Project at Stanford University quantifies various ecosystem services under different planning scenarios. This research uses InVEST to evaluate the City of Corvallis’s Urban Growth Management program in conserving its urban fringe area’s ecological values by quantifying three dimensions of ecosystem service: stormwater retention, stormwater purification and carbon sequestration. The results show that from 2000 to 2020, more than 14 square miles of land are planned to be urbanized. Under the City’s current planning policy, the carbon storage drops by 14.50%; the amount of nitrogen in the stormwater increases by 55.90%; and the amount of phosphorus soars by 162.54%.*

### **1.1 Keywords**

Urban Growth Management, Ecosystem Services, Land Value, InVEST, Corvallis, OR



# 1 INTRODUCTION

## 1. Urbanization and Urban Growth Management

Urbanization has been

rapidly spreading in both

developing and developed

countries at the global

scales (Annez and Buckley

2009). And the global

urban population has been

raising rapidly since 1950s,

from less than eight hundred millions in 1950 to nearly four billions in 2014 (United Nations 2014).

Due to the advantages in modernization, industrialization and the sociological process of

rationalization, during which traditional thinking ways were replaced by the analysis addressing

social control, urbanization is inextricable urbanization in the coming decades (Wang et al 2002). The

2014 World Urbanization Prospects predicts that the urban population would reach to 6.5 billion in

2050, which accounts for 66 percentage of the world's total population (United Nations 2014).

Urbanization has brought substantial social and economic development to our world, which results

in more job opportunity and more efficient ways of using resources (United Nations Population Fund

2015). However, through land use and land cover change, urbanization has been posing negatively

impacts on “eco-environment” at multiple scales (Wang et al 2002). For example, Faulkner (2004)

found that urbanization in the southern United States has damaged forest and wetland ecosystems

through fragmenting wildlife habitat, reducing biodiversity and disturbing biotic community

functionality. Through collecting emission inventory data and building the population exposure

spatial model in two Chinese cities, Peng, et al. (2004) found that the rapid urbanization process

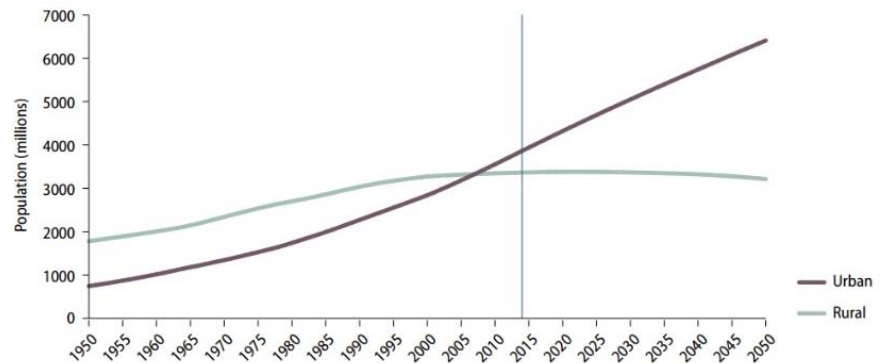
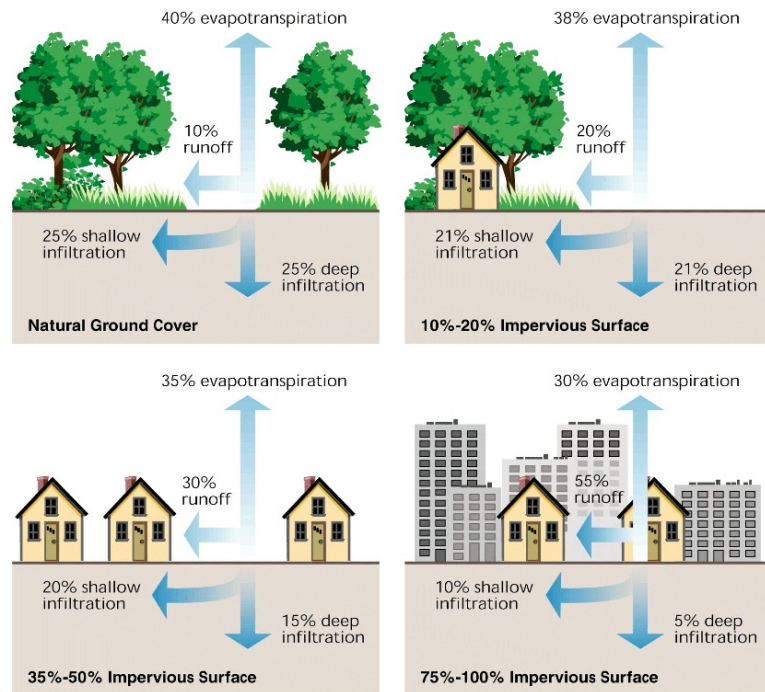


Fig. 1. Urban and Rural Population of the World, 1950 – 2050. Source: United Nations, 2014. Department of Economic and Social Affairs, Population Division World Urbanization Prospects: The 2014 Revision, ...

results in high concentration of airborne fine particles which leads to the urban haze and does deadly damage to human's respiratory system. As urbanization proceeds, a substantial amount of carbon stored in terrestrial natural ecosystems is released into the air (Conte et al 2011). For example, Gibbs et al (2007) found that more than two thirds of total carbon emissions come from deforestation because of urban sprawl in the Africa from 1990 to 2000. Urbanization has been proven to impact the hydrological cycle. In the urban area, the natural pervious ground surface is replaced by impervious pavement,



*Degrees of Imperviousness and its Effects on Stormwater Runoff. By the Federal Interagency Stream Restoration Working Group (FISRWG)*

and the large percentage of impervious surface in urban watersheds results in less water evapotranspiration, less stormwater retention and more flash flooding during intensive precipitation events (Brilly et al 2006). For example, Rose and Peters (2001) documented stream flow in twenty-five streams in Georgia for 40 years and their research showed that the peak flow in the urban area is 30% - 100% higher than it in rural areas. Nirupama and Simonovic (2006) explored the correlation between the size of urban areas and flow discharges in the Thames River basin, and they drew the conclusion that because of the progressive upstream urbanization, the flooding risk has been significantly increased for the City of London, Ontario, Canada. Urbanization has also proven to be a factor affecting surface water quality and heavy

metals, total phosphorous and total nitrogen in urban storm water are typically above standard levels (Fletcher et al 2007, Goonetilleke et al 2005). Through analyzing data from twelve stream sites located in a rural stream, a suburban stream and an urban stream, Mallin et al



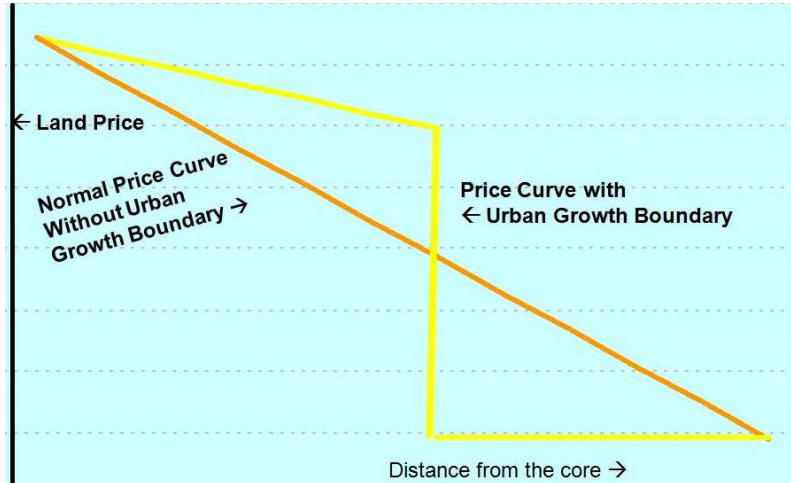
(2009) found that urban stream carries more nitrogen and phosphorus than the rural stream (BOD), total suspended sediment (TSS) and surfactant concentrations than the rural stream and the rural stream do. While the environmental effect of urbanization have long been known, modern tools enable a better understanding of urbanization and its effects on ecological processes.

## 2. Literature Review

Scholars have studied the performance of urban growth management strategies in conserving ecological values, and the results vary due to different scales and research methods. This dissertation briefly reviews the effects of urban growth management on ecosystem conservation and its influence on land price. Then the literature review focuses on a comprehensive overview of the evaluation of the urban spatial planning policy through ecological quantification modeling. Through the literature review, it is concluded that new methodologies and models that could address both the local lands' ecological and economic value changes are needed in exploring the effects of the Urban Growth Management policy.

One of the original goals of the Urban Growth Management policy is to restrain urban sprawl and preserve natural resources. Scholars have studied the performance of urban growth management in environment conservation. Frenkel (2004) researched the role of growth management policy in concentrating urban development and environmental conservation at the national level in Israel. Through running the Land Consumption model and a comparison of different planning scenarios, Frenkel found that the urban growth management policy taking place from 1990 to 2000 reduced unprotected open space loss from 8.2% to 6.5% and dropped farmland loss from 11.1% to 8.7%. Similarly, Nelson (1992) demonstrated that Oregon's planning policies including urban growth management, urban growth boundaries, and exurban development separation play an important role in conserving productive farmland and forest. Gordon et al (2009) indicated that the urban growth management in the City of Melbourne Australia could be an effective planning tool in protecting threatened species habitat. Cathcart et al (2006) made the conclusion that through directing urban development into the urban growth boundary, the natural resources preserved by Oregon's planning program could potentially capture substantial carbon dioxide up to 15 million tons in the future ten years. However the adverse effects of urban growth management policy are also pointed out by some scholars. Robinson et al (2005) argued that under the urban growth management, urban density within the urban growth boundary did increase in the past 25 years in the Seattle region. However low-density development has been increasingly sprawling in natural areas outside the boundary. Based on the database and plant community inventory collected by United State Department of Agriculture, Kline and Alig (1999) made the similar conclusion that in Oregon, development under the urban growth management is tending to be more intensive within the urban growth boundary, but it is not clear that the tendency of development within forest and farmland is decreased outside of the boundary.

Many scholars have studied the relationship between the Urban Growth Management and land prices. Lillydahl (1987) note that the urban growth management policy has the potential to dampen



development by increasing land and housing prices. Knapp and

*UGBs (Urban Growth Boundaries): Against Nature and Humanity*  
(Source: *Urbanity*, by Randall Facts & Views on Living Spaces.

Nelson (1988) argue that the urban growth management policy can increase property prices because it restrains the supply of developable urban land. In addition, the Urban Growth Management enhances the environmental quality of land parcels that are inside but close to the urban growth boundary. These parcels might enjoy the open space and the expansive views provided by the low-density development outside the boundary. Some research has demonstrated that the property price rises because of environmental amenities improvement (Cho et al., 2008; Geoghegan, 2002; Seo and von Rabenau, 2011).

However, Dawkins (2002) argue that similar with other commercial goods, whether or not the urban growth management policy is impacting property values ultimately depends on the relationship of demand and supply elasticity. The Urban Growth Management policy may not increase the house prices if the flexible land supply could mitigate the inflationary pressure on the land prices by bringing in new supply. This might explain Mathur's (2013) finding that the property value around the urban growth boundary is slightly decreasing in King County, Washington.

Through a previous literature review, it was noted that although there are some studies evaluating the performance of urban growth management in environmental conservation, the results vary due to different scales and research perspectives. Few studies explore this question based on ecosystem service quantification, which is a comprehensive framework to explore the relationship between nature and society and could directly indicate the extent of environmental conservation under different planning scenarios (Heldal and Baszka 2012). This literature then reviews the application of ecosystem services modeling in urban planning in the past ten years by searching on the Web of Science with key words of “Urban Planning” AND “Ecosystem Service Quantification” OR “Ecological Values Quantification”.

Dupras et al (2014) pointed out that due to the lack understanding of natural capital and ecosystem services, planning policy may have unknowingly been contributing to the degradation of the environment. Dupras maps the total non-market values of biodiversity in the Greater Montreal area in Canada and through mapping the distributions of the values of ecosystem services, decision-makers are able to make more effective land planning policies. In Dupras’ study, the methodology to quantify the ecological values provided by forests, woodlands and urban wetlands is calculating the area amount of those three land covers in ArcGIS and using the secondary data regarding to the economic values of the ecosystem services provided by the Environmental Valuation Reference Inventory Database (Dupras et al 2014). A similar method was used by Zhou (2014) in quantifying the relationship between the ongoing process of urbanization and the corresponding loss of ecological values in the City of Wuhan, China. Zhou et al (2014) explores the influences of three developing urban patterns on the ecological values by quantifying the urbanization patterns, determining the changes in ecosystem services and attempting to build the Pearson Correlation between those two factors. The method to quantify the ecosystem services changes in this case is to quantify the

landscape patterns in the process of urbanization and use the secondary data provided by the Ecosystem Service Valuation Coefficients for China, which is developed by Xie et al. (2003). The weakness of this method is that it assumes the same land use land cover type provides the exactly same ecological values regardless of the different locations, various climate and biophysical situations (for example, the different soil conditions), and different structural components (for example, the different plant components of urban forests and urban wetlands).

Liu and Li (2012) quantify the carbon sequestration and storage by the urban forest in the City of Shenyang, China. The improvement in their method is that rather than using the same general ecosystem services valuation index for all types of urban forests, Liu and Li used the satellite images and the field survey to document the planting species in the urban forests. Then the Biomass Equation was applied to quantify the carbon storage of each type of species. This study also demonstrates that the ability to store carbon varies among different urban forest types with different “species composition and age structure” (Liu and Li 2012). However this study still does not take into consideration various biophysical conditions.

Jansson and Colding (2007) used the Transport, Retention, Kallfordelling (TRK) model (a hydrological model) to quantify the nitrogen loading to the Baltic Sea from Stockholm County both under the present scenario and two alternative future development scenarios predicted by the county’s planning department. Schaffler and Swilling (2012) used the same method to calculate the size of the vegetation components and quantified the ecosystem services provided by the urban green infrastructure in Johannesburg, South Africa. Compared to the methodologies mentioned earlier, these methods are more accurate by using the local data instead of the ecosystem services quantification reference index. But this method requires extensive field surveys to create accurate localized standard values.

InVEST (Integrated Valuation of Ecosystem Services and Tradeoffs) was developed by the Natural Capital Project at Stanford University to quantify the ecosystem services under different planning scenarios and assess how the ability to provide ecosystem services could be affected by alternative plans (Mckenzie, et al 2011). Yang et al. (2012) applies InVEST to quantify an urban watershed's ability to provide ecosystem services in producing agriculture, generating hydropower and improving water quality, and analyzes the tradeoffs among them under five alternative urban planning scenarios in the City of Baiyangdian, China. Based on the ecosystem services qualification results, the author argues that areas with high ecological values could be located for conservation in further study (Yang et al. 2012). This has been demonstrated by Liu et al (2013) who used InVEST to identify the areas with high ecological values in storing carbon, producing timber, generating hydropower, improving water quality and retaining sediment in Fuzhou, China. After generating the ecosystem services quantification results, this paper applied the "ordered weighted averaging (OWA)" methodology to make the conservation planning scenarios that address the tradeoffs of the ecosystem services (Liu et al. 2013).

Ecosystem service quantification in the human built environment is crucial for further alleviating urbanization's negative influence on natural resources (Jansson and Colding 2007). But through the literature review, limited studies were found to incorporate ecosystem service quantification into environmental conservation and land use decision-making. Few studies used the ecological models to quantify the ecosystem services provided either by the rural landscape or urban landscape. However, these studies could barely attract the policy maker's attention because it cannot transfer the ecological values into the economic values at a local community or neighborhood scale. People would appreciate the environment benefits more if they have an understanding of what an important role their community or neighborhood is playing in providing ecosystem services.



Therefore it is strongly recommended that new methodologies and models that can address both the local lands' ecological values and economic values are developed to assist in exploring the effects the land use policy, specifically the Urban Growth Management.

Through reviewing the application of ecosystem services modeling in urban planning, three methods were summarized to quantify the ecological values as follows:

- Simple Biomass Equation:  $\text{Area} \times \text{Ecosystem Service Index}$ .
- Advanced Biomass Equation:  $\text{Area} \times \text{Ecosystem Service Index}$  (More land cover pattern, local data and field survey).
- Advanced Biophysical Models: Advanced Biomass Equation in Various Biophysical Conditions.

Through reviewing the application of ecosystem services modeling in urban planning, three methods were summarized to quantify the ecological values as follows:

- Simple Biomass Equation:  $\text{Area} \times \text{Ecosystem Service Index}$ .
- Advanced Biomass Equation:  $\text{Area} \times \text{Ecosystem Service Index}$  (More land cover pattern, local data and field survey).
- Advanced Biophysical Models: Advanced Biomass Equation in Various Biophysical Conditions.

### 3. Research Area and Research

#### Objectives

The City of Corvallis (City) is in Benton County in Oregon. It is located near the middle of the Willamette Valley (City of Corvallis 2002). The City is within 90 minutes' drive of the Portland Metropolitan area. The City's population grows from 44,816 in 1990 to 54,953 in 2013 (U.S. Census Bureau 2014). The City has a total area of 14.40 square miles, of

which 0.17 square miles is water and 14.23 square miles is land (U.S. Census Bureau 2011).

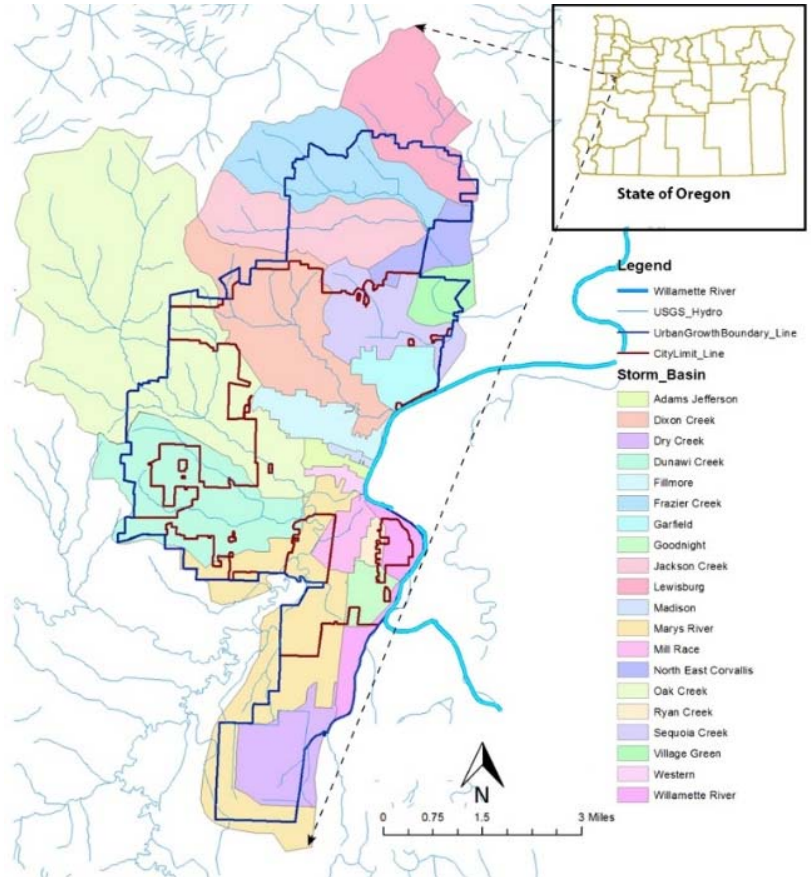
According to the National Land Cover

*The City of Corvallis, Oregon and Storm Basin*

Database in 2011, the city has 15 land use and land cover categories.

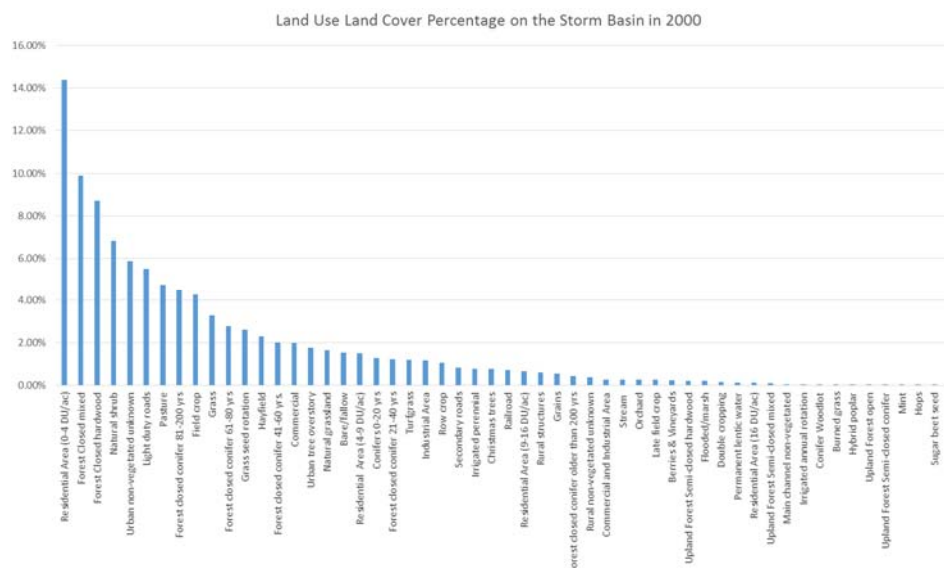
The City intersects with Willamette River Watershed (HUC 1709000306) and Marys River Watershed (HUC 1709000302) in Central Western Oregon, and encompasses 20 subwatersheds.

. Willamette River does not meet the water quality standard established by EPA's Clean Water Act and the City developed the Total Maximum Daily Loads (TMDL) model for the Willamette Basin in 2006. According to the Willamette Basin TMDL model, it requires at least 20 years and \$100 million to meet the water quality standard. The City's waste water treatment plant discharges into the Willamette River and urban stormwater has been negatively impacted the water quality in urban streams and the Willamette River (City of Corvallis 2007).

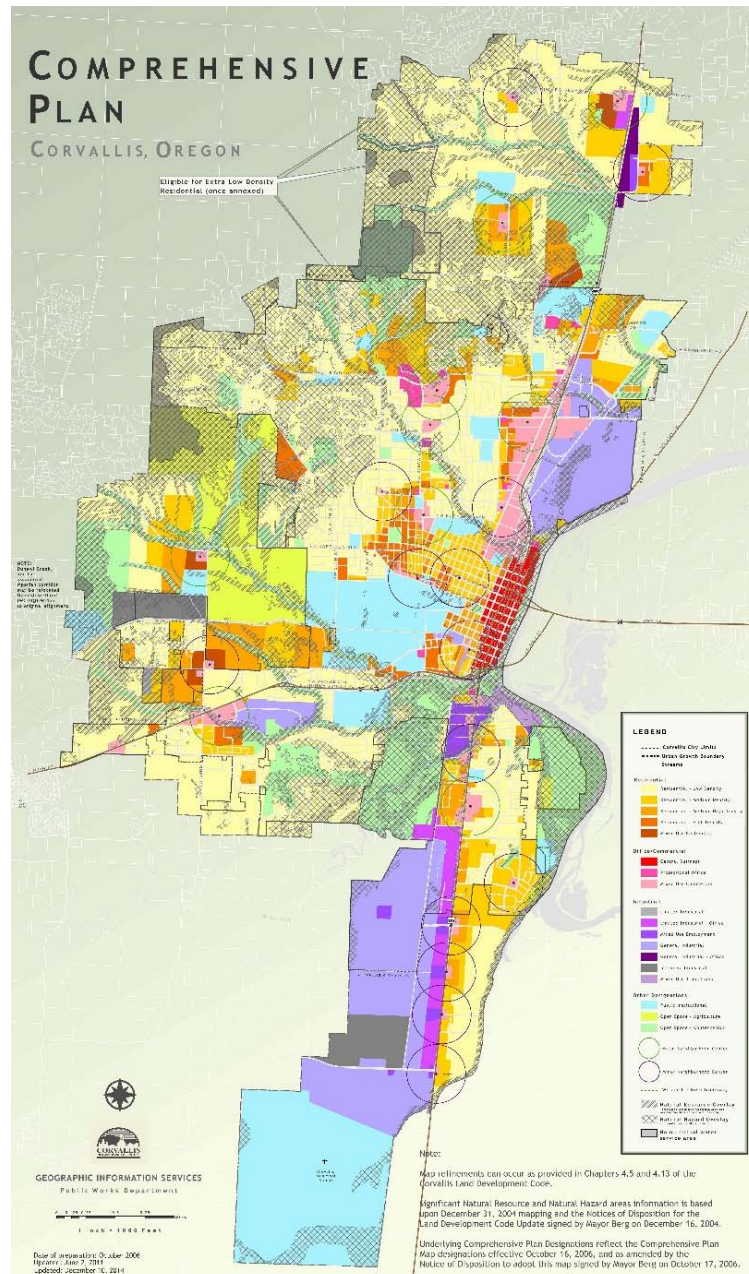


Land Use and Land Cover	Area (m2)	Percentage	Land Use and Land Cover	Area (m2)	Percentage
Residential Area (0-4 DU/ac)	17156700	14.38%	Forest closed conifer older than 200 yrs	513900	0.43%
Residential Area (4-9 DU/ac)	1794600	1.50%	Upland Forest Semi-closed hardwood	238500	0.20%
Residential Area (9-16 DU/ac)	792000	0.66%	Hybrid poplar	32400	0.03%
Residential Area (16 DU/ac)	138600	0.12%	Grass seed rotation	3087000	2.59%
Commercial	2358000	1.98%	Irrigated annual rotation	54000	0.05%
Commercial and Industrial Area	321300	0.27%	Grains	657900	0.55%
Industrial Area	1392300	1.17%	Berries & Vineyards	292500	0.25%
Urban non-vegetated unknown	7012800	5.88%	Double cropping	177300	0.15%
Rural structures	702900	0.59%	Hops	900	0.00%
Railroad	864000	0.72%	Mint	15300	0.01%
Secondary roads	972000	0.81%	Sugar beet seed	900	0.00%
Light duty roads	6559200	5.50%	Row crop	1246500	1.04%
Rural non-vegetated unknown	459000	0.38%	Grass	3894300	3.26%
Main channel non-vegetated	54900	0.05%	Burned grass	37800	0.03%
Stream	317700	0.27%	Field crop	5090400	4.27%
Permanent lentic water	156600	0.13%	Hayfield	2744100	2.30%
Urban tree overstory	2095200	1.76%	Late field crop	306000	0.26%
Upland Forest open	24300	0.02%	Pasture	5639400	4.73%
Upland Forest Semi-closed mixed	111600	0.09%	Natural grassland	1962900	1.64%
Forest Closed hardwood	10387800	8.70%	Natural shrub	8140500	6.82%
Forest Closed mixed	11803500	9.89%	Bare/fallow	1820700	1.53%
Upland Forest Semi-closed conifer	22500	0.02%	Flooded/marsh	229500	0.19%
Conifers 0-20 yrs	1522800	1.28%	Irrigated perennial	918000	0.77%
Forest closed conifer 21-40 yrs	1453500	1.22%	Turfgrass	1411200	1.18%
Forest closed conifer 41-60 yrs.	2401200	2.01%	Orchard	314100	0.26%
Forest closed conifer 61-80 yrs	3313800	2.78%	Christmas trees	917100	0.77%
Forest closed conifer 81-200 yrs	5357700	4.49%	Conifer Woodlot	46800	0.04%

### Land Use and Land Cover on the Storm Basin in 2000



The City implemented its first comprehensive plan in 1980 and it was updated in 1990 and 1998 in the periodic reviews (City of Corvallis, 2006). The comprehensive plan currently used by the city was developed by the city's planning division in 1998 and was acknowledged by



Oregon Land Conservation and Development Commission on June 26, 2000. On December 31,

2006 it *Comprehensive Plan, Corvallis Oregon Source (The City of Corvallis, updated December 2014)* was officially

approved and implemented by the City Council.

The current Comprehensive Plan Statement is in conformance with Oregon Statewide Goals and envisions in 2020, the city is going to be:

- A Compact City with Population Ranging from 57,500 to 63,500;
- The economic, cultural and political center of Benton County;
- An Environmental-friendly community with beautiful and functional natural landscape
- An Integrated City with Stable and Clean Economy;
- A Community Filled with Arts and Recreation;
- A Community in Supports for its Kids and Families;
- City Applying Local Standard to Assess its Development Progress in Area such as Life Quality,

Housing Vitality and Environment Quality;

- Community in Support of High Education Quality;
- City Providing Comprehensive Services for Elderly People and Disabled People;
- Regional Transportation Center Connecting Benton County, Linn County and Rail System;
- City Involve its Citizens in Policy and Decision Making;
- Various Community without prejudice and Discrimination;
- Excellent City for People to Study, Work and Live (City of Corvallis 1998).

According to the City's 2014 updated Comprehensive Plan, The current Corvallis city limit encompasses 14.4 square miles and the area circumscribed by the urban growth boundary is 28.1 square miles (City of Corvallis, 2014). Therefore the area within the urban growth boundary (UGB) but outside the city limit, which is referred to as urban fringe, is nearly 14 square miles. In 2006, these areas are mainly covered with forest and pasture. According to the City of Corvallis's Land Development Code, this urban fringe area is going to be filled mostly with general industry, residential neighborhoods, public institutes and open space.

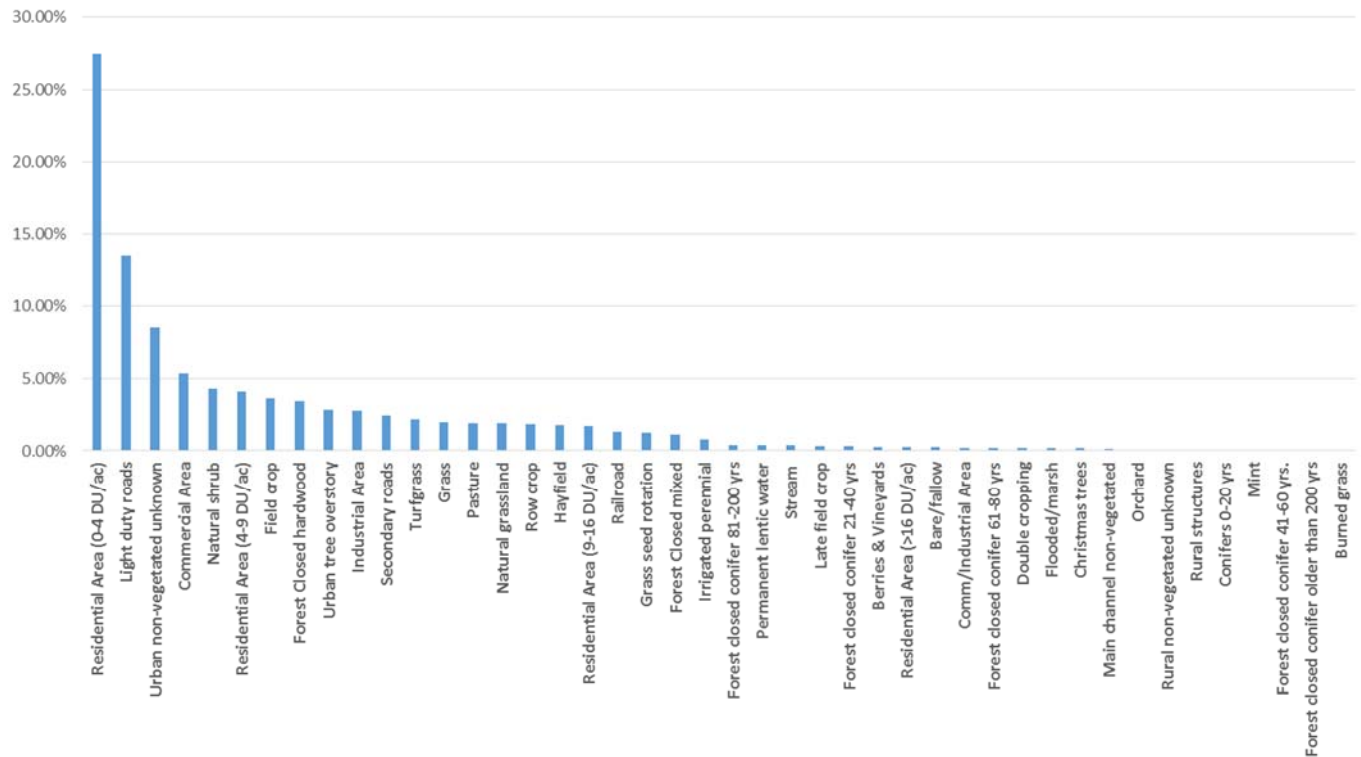


*Land Cover on the Storm Basin, City Limit, Urban Growth Boundary and Urban Fringe.*



Land Use and Land Cover	Area (m <sup>2</sup> )	Percentage	Land Use and Land Cover	Area (m <sup>2</sup> )	Percentage
Residential Area (0-4 DU/ac)	10482580	27.48%	Forest closed conifer 61-80 yrs	73869	0.19%
Residential Area (4-9 DU/ac)	1564825	4.10%	Forest closed conifer 81-200 yrs	156033	0.41%
Residential Area (9-16 DU/ac)	661166	1.73%	Forest closed conifer older than 200 yrs	3600	0.01%
Residential Area (>16 DU/ac)	100974	0.26%	Grass seed rotation	468566	1.23%
Commercial Area	2053540	5.38%	Berries & Vineyards	102041	0.27%
Comm/Industrial Area	76500	0.20%	Double cropping	73356	0.19%
Industrial Area	1049432	2.75%	Mint	10432	0.03%
Urban non-vegetated unknown	3249058	8.52%	Row crop	704532	1.85%
Rural structures	13080	0.03%	Grass	752091	1.97%
Railroad	502230	1.32%	Burned grass	2700	0.01%
Secondary roads	923266	2.42%	Field crop	1384409	3.63%
Light duty roads	5143038	13.48%	Hayfield	687913	1.80%
Rural non-vegetated unknown	17584	0.05%	Late field crop	130714	0.34%
Main channel non-vegetated	51757	0.14%	Pasture	724386	1.90%
Stream	139770	0.37%	Natural grassland	720265	1.89%
Permanent lentic water	149141	0.39%	Natural shrub	1630108	4.27%
Urban tree overstory	1082213	2.84%	Bare/fallow	100936	0.26%
Forest Closed hardwood	1317699	3.45%	Flooded/marsh	72857	0.19%
Forest Closed mixed	426194	1.12%	Irrigated perennial	291770	0.76%
Conifers 0-20 yrs	10800	0.03%	Turfgrass	836162	2.19%
Forest closed conifer 21-40 yrs	117897	0.31%	Orchard	20265	0.05%
Forest closed conifer 41-60 yrs.	9492	0.02%	Christmas trees	63848	0.17%

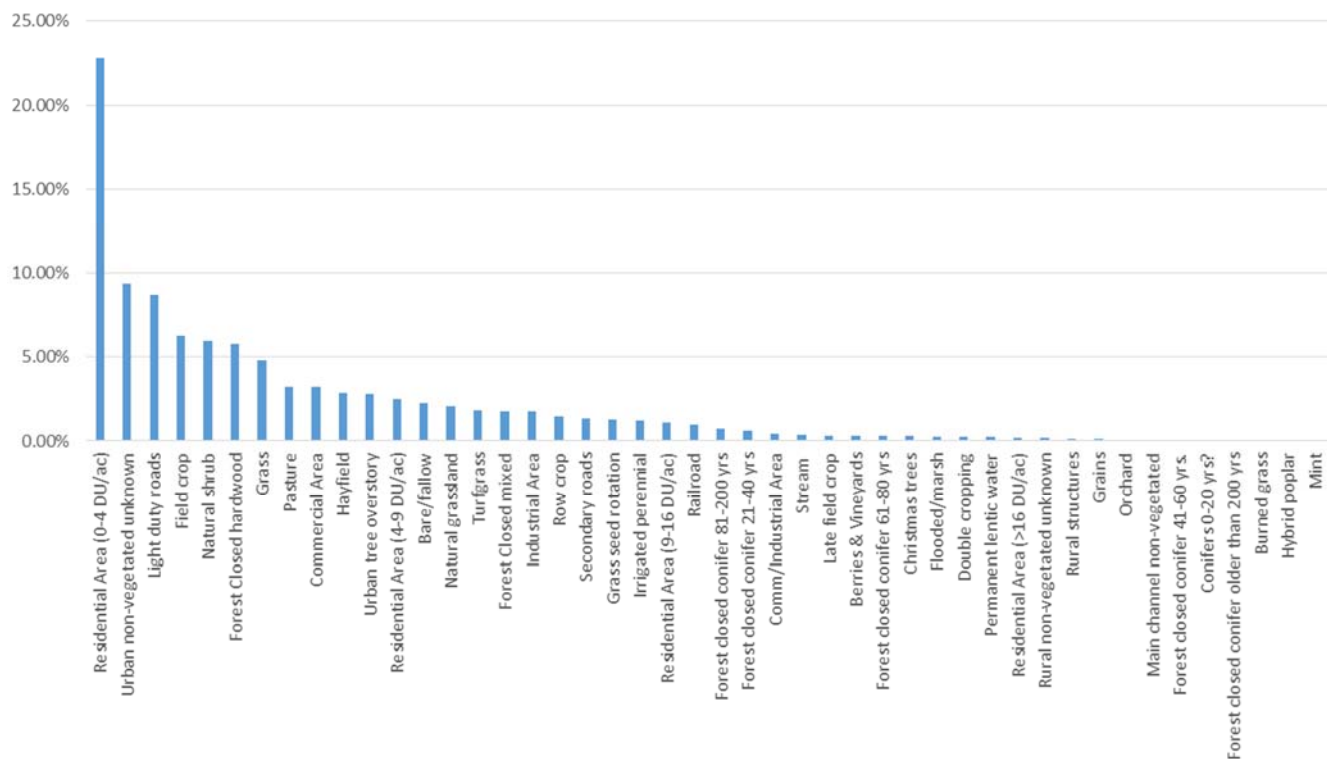
LAND USE LAND COVER PERCENTAGE WITHIN CITY LIMIT IN 2000



Land Cover and Land Use within City Limit in 2000

Land Use and Land Cover	Area (m2)	Percentage	Land Use and Land Cover	Area (m2)	Percentage
Residential Area (0-4 DU/ac)	16520226	22.80%	Forest closed conifer 81-200 yrs	512727	0.71%
Residential Area (4-9 DU/ac)	1794600	2.48%	Forest closed conifer older than 200 yrs	28673	0.04%
Residential Area (9-16 DU/ac)	792000	1.09%	Hybrid poplar	21042	0.03%
Residential Area (>16 DU/ac)	138600	0.19%	Grass seed rotation	934051	1.29%
Commercial Area	2315423	3.20%	Grains	69533	0.10%
Comm/Industrial Area	301047	0.42%	Berries & Vineyards	230772	0.32%
Industrial Area	1269377	1.75%	Double cropping	166253	0.23%
Urban non-vegetated unknown	6768761	9.34%	Mint	14400	0.02%
Rural structures	80346	0.11%	Row crop	1070034	1.48%
Railroad	703224	0.97%	Grass	3488888	4.81%
Secondary roads	953523	1.32%	Burned grass	21720	0.03%
Light duty roads	6277015	8.66%	Field crop	4541225	6.27%
Rural non-vegetated unknown	133333	0.18%	Hayfield	2078653	2.87%
Main channel non-vegetated	53762	0.07%	Late field crop	238607	0.33%
Stream	266927	0.37%	Pasture	2317226	3.20%
Permanent lentic water	152686	0.21%	Natural grassland	1472664	2.03%
Urban tree overstory	2026781	2.80%	Natural shrub	4307445	5.94%
Forest Closed hardwood	4156638	5.74%	Bare/fallow	1633451	2.25%
Forest Closed mixed	1286531	1.78%	Flooded/marsh	171519	0.24%
Conifers 0-20 yrs?	33300	0.05%	Irrigated perennial	864467	1.19%
Forest closed conifer 21-40 yrs	418139	0.58%	Turfgrass	1330074	1.84%
Forest closed conifer 41-60 yrs.	53249	0.07%	Orchard	56814	0.08%
Forest closed conifer 61-80 yrs	204186	0.28%	Christmas trees	199547	0.28%

LAND USE LAND COVER PERCENTAGE WITHIN URBAN GROWTH BOUNDARY IN 2000



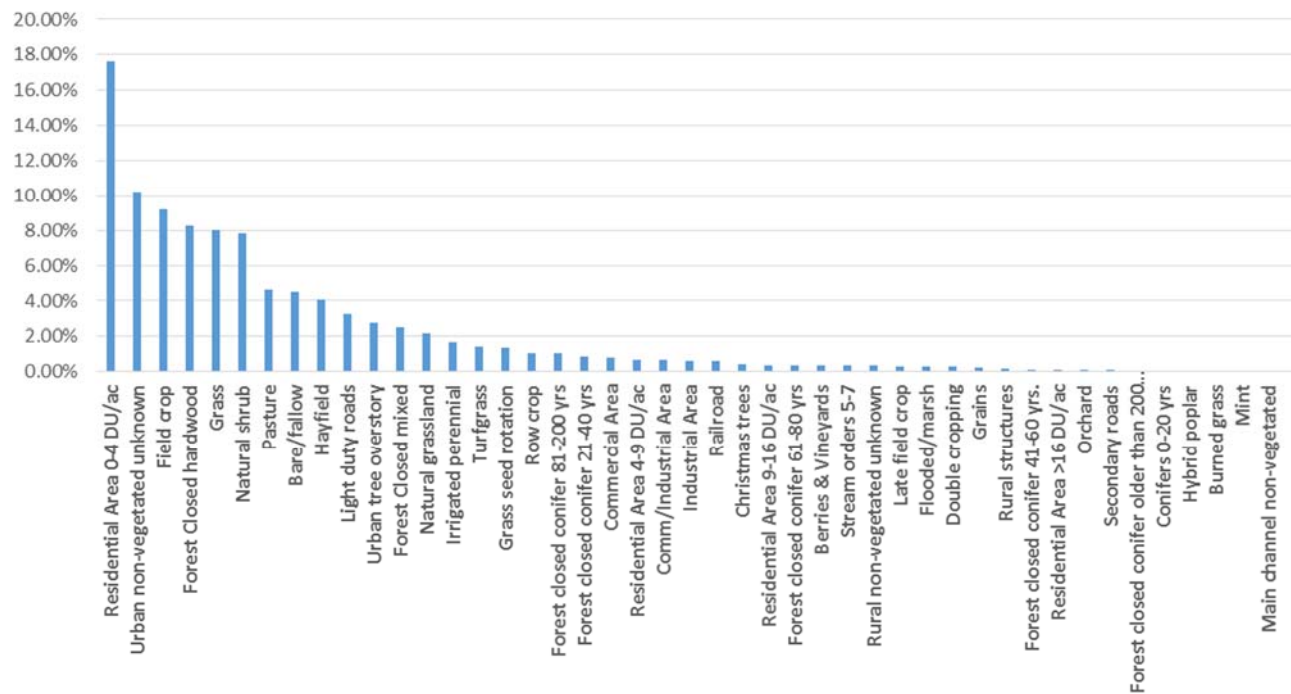
in 2000

Land Cover and Land Use within the Urban Growth Boundary



Land Use and Land Cover	Aare (m2)	Percentage	Land Use and Land Cover	Aare (m2)	Percentage
Residential Area 0-4 DU/ac	6021415	17.60%	Forest closed conifer older than 200 yrs	25073	0.07%
Residential Area 4-9 DU/ac	229607	0.67%	Hybrid poplar	21042	0.06%
Residential Area 9-16 DU/ac	130729	0.38%	Grass seed rotation	464730	1.36%
Residential Area >16 DU/ac	37558	0.11%	Grains	69533	0.20%
Commercial Area	261916	0.77%	Berries & Vineyards	128502	0.38%
Comm/Industrial Area	224547	0.66%	Double cropping	92900	0.27%
Industrial Area	212808	0.62%	Mint	3600	0.01%
Urban non-vegetated unknown	3498288	10.23%	Row crop	362176	1.06%
Rural structures	67236	0.20%	Grass	2733509	7.99%
Railroad	200534	0.59%	Burned grass	18751	0.05%
Secondary roads	30284	0.09%	Field crop	3151135	9.21%
Light duty roads	1109608	3.24%	Hayfield	1390264	4.06%
Rural non-vegetated unknown	115743	0.34%	Late field crop	100886	0.29%
Main channel non-vegetated	2051	0.01%	Pasture	1592124	4.65%
Stream orders 5-7	126876	0.37%	Natural grassland	751439	2.20%
Urban tree overstory	941205	2.75%	Natural shrub	2674061	7.82%
Forest Closed hardwood	2834092	8.29%	Bare/fallow	1531615	4.48%
Forest Closed mixed	860261	2.52%	Flooded/marsh	97961	0.29%
Conifers 0-20 yrs	22500	0.07%	Irrigated perennial	571380	1.67%
Forest closed conifer 21-40 yrs	299776	0.88%	Turfgrass	493625	1.44%
Forest closed conifer 41-60 yrs.	43757	0.13%	Orchard	36561	0.11%
Forest closed conifer 61-80 yrs	130316	0.38%	Christmas trees	135534	0.40%
Forest closed conifer 81-200 yrs	356694	1.04%			

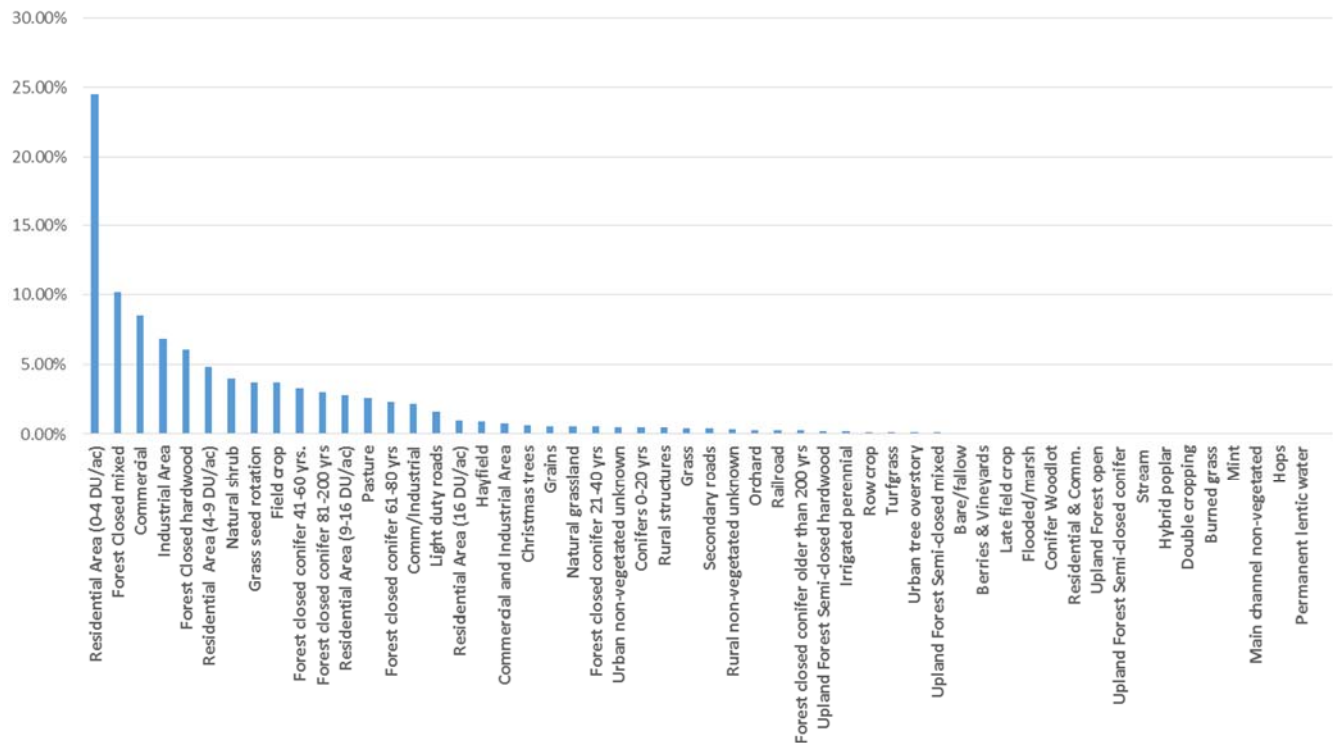
### LAND USE LAND COVER PERCENTAGE IN URBAN FRINGE 2000



Land Cover and Land Use of Urban Fringe in 2000

Land Use and Land Cover	Area (m2)	Percentage	Land Use and Land Cover	Area (m2)	Percentage
Residential Area (0-4 DU/ac)	27243240	24.56%	Forest closed conifer 61-80 yrs	2549098	2.30%
Residential Area (4-9 DU/ac)	5418328	4.88%	Forest closed conifer 81-200 y	3325949	3.00%
Residential Area (9-16 DU/ac)	3083841	2.78%	Forest closed conifer older th	276004	0.25%
Residential Area (16 DU/ac)	1070270	0.96%	Upland Forest Semi-closed h	230248	0.21%
Commercial	9408032	8.48%	Hybrid poplar	11446	0.01%
Comm/Industrial	2443372	2.20%	Grass seed rotation	4146191	3.74%
Industrial Area	7560850	6.82%	Grains	621626	0.56%
Commercial and Industrial Area	835832	0.75%	Berries & Vineyards	92159	0.08%
Residential & Comm.	36797	0.03%	Double cropping	5222	0.00%
Urban non-vegetated unknown	576753	0.52%	Hops	900	0.00%
Rural structures	528181	0.48%	Mint	3163	0.00%
Railroad	288329	0.26%	Row crop	193285	0.17%
Secondary roads	435934	0.39%	Grass	500049	0.45%
Light duty roads	1817583	1.64%	Burned grass	3278	0.00%
Rural non-vegetated unknown	369465	0.33%	Field crop	4113937	3.71%
Main channel non-vegetated	2712	0.00%	Hayfield	1020725	0.92%
Stream	25705	0.02%	Late field crop	83117	0.07%
Permanent lentic water	150	0.00%	Pasture	2905001	2.62%
Urban tree overstory	170587	0.15%	Natural grassland	596555	0.54%
Upland Forest open	32972	0.03%	Natural shrub	4429311	3.99%
Upland Forest Semi-closed mixed	125621	0.11%	Bare/fallow	96532	0.09%
Forest Closed hardwood	6678480	6.02%	Flooded/marsh	73401	0.07%
Forest Closed mixed	11273286	10.16%	Irrigated perennial	229172	0.21%
Upland Forest Semi-closed conifer	30311	0.03%	Turfgrass	181266	0.16%
Conifers 0-20 yrs	556919	0.50%	Orchard	298623	0.27%
Forest closed conifer 21-40 yrs	588847	0.53%	Christmas trees	677399	0.61%
Forest closed conifer 41-60 yrs.	3633098	3.27%	Conifer Woodlot	43343	0.04%

LAND USE LAND COVER PERCENTAGE IN STORM BASIN 2020

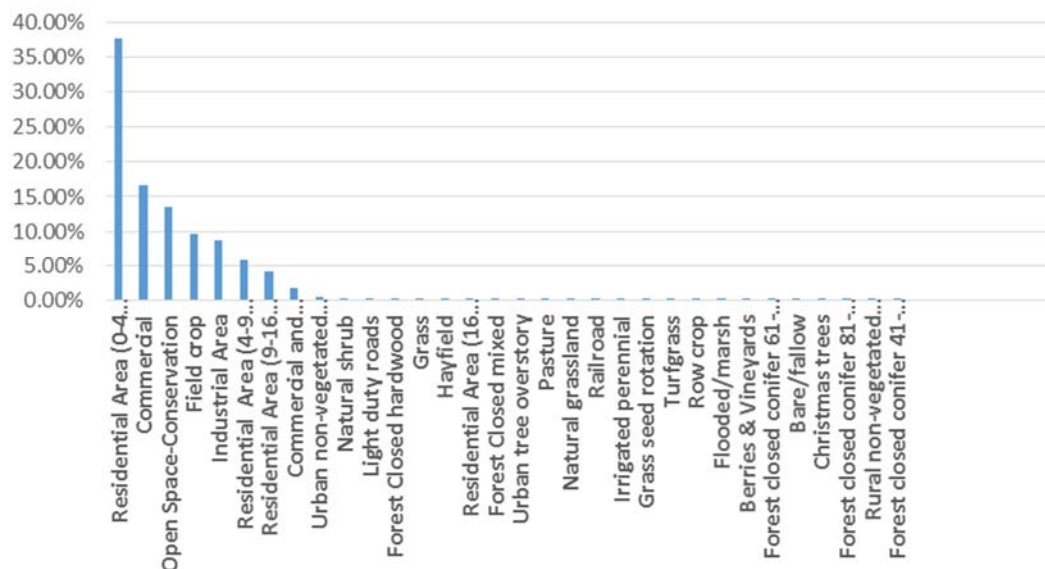


Projected Land Use and Land Cover in Stormbasin in

2020

Land Use and Land Cover	Area (m2)	Percentage	Land Use and Land Cover	Area (m2)	Percentage
Residential Area (0-4 DU/ac)	12972344	37.75%	Forest closed conifer 81	4018	0.01%
Residential Area (4-9 DU/ac)	1967806	5.73%	Grass seed rotation	20127	0.06%
Residential Area (9-16 DU/ac)	1374448	4.00%	Berries & Vineyards	5201	0.02%
Residential Area (16 DU/ac)	41874	0.12%	Row crop	8008	0.02%
Commercial	5705264	16.60%	Grass	61222	0.18%
Industrial Area	2987035	8.69%	Field crop	3300783	9.61%
Commercial and Industrial Area	587301	1.71%	Hayfield	52269	0.15%
Urban non-vegetated unknown	117207	0.34%	Pasture	31881	0.09%
Railroad	24834	0.07%	Natural grassland	31655	0.09%
Light duty roads	94221	0.27%	Natural shrub	95603	0.28%
Rural non-vegetated unknown	3495	0.01%	Bare/fallow	4637	0.01%
Urban tree overstory	32521	0.09%	Flooded/marsh	5990	0.02%
Forest Closed hardwood	89920	0.26%	Irrigated perennial	22225	0.06%
Forest Closed mixed	38624	0.11%	Turfgrass	12898	0.04%
Forest closed conifer 41-60 yrs.	2583	0.01%	Christmas trees	4545	0.01%
Forest closed conifer 61-80 yrs	5014	0.01%	Open Space-Conservatic	4649185	13.53%

LAND USE LAND COVER PERCENTAGE URBAN FRINGE 2020



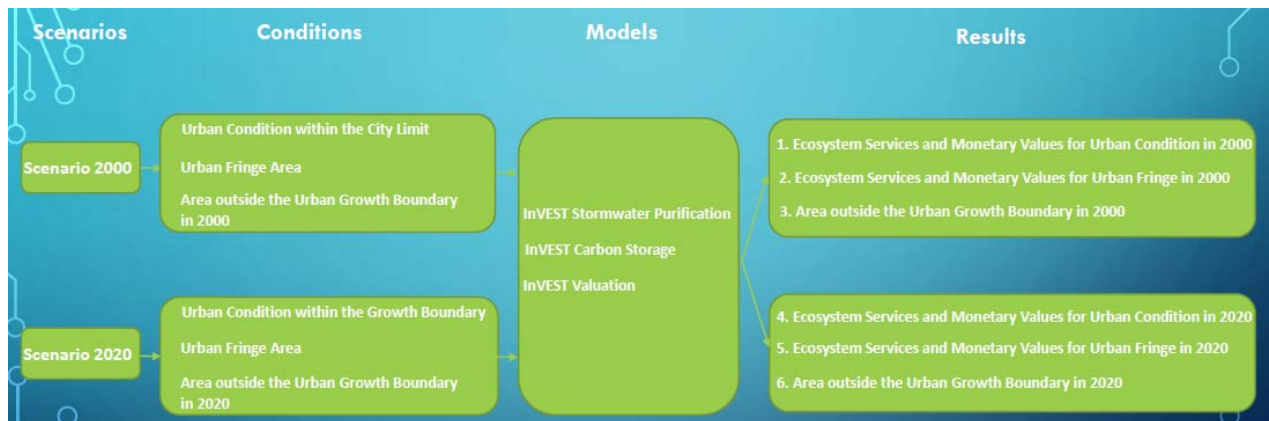
Land Use and Land Cover Percentage in Urban Fringe in 2020

According to the Comprehensive Plan, the City is divided into three different areas: the Area within the City Limit, the Area between the City Limit and the Urban Growth Boundary and the Area outside the Urban Growth Boundary. This research quantify these three areas' ability to provide ecosystem services in stormwater purification and carbon storage in both 2000 and 2020 based on the current planning policy.

#### **4. Research Methodology**

The research methodology in this study could be briefly described as generating planning scenarios based on research objectives in ArcGIS, collecting secondary data and running InVEST biophysical models with the land use and land cover data. This study uses the land use and land cover data in 2000, which is provided by the InVEST package and the land use and land cover data in 2020, which is predicted by the author based on the Comprehensive Plan and Subdivision Regulations. Both of these two land use and land cover data utilize data pixel of 30m x 30m. Ecosystems provide a flow of services that are significant to human including the production of goods (e.g., food), life-support processes (e.g., water purification), and life-fulfilling conditions (e.g., beauty, recreation opportunities), and the conservation of options (e.g., genetic diversity for future use). InVEST and ARIES are the most commonly used modeling tools in ecosystem services quantification. InVEST (Integrated Valuation of Ecosystem Services and Tradeoffs) consists of a set of models dependent on ArcGIS to quantify the ecosystem services under different planning scenarios (Mckenzie, et al 2011). ARIES (Artificial Intelligence for Ecosystem Services), developed by the University of Vermont, quantifies ecosystem services in a way that “acknowledges dynamic complexity and its consequences” while keeping the model simple enough to be tractable (Villa et.al 2014). InVEST is more suitable in a situation in which the undergoing ecological process is well understood; and ARIES is more suitable in a situation of data inaccessibility (Vigerstol and Aukema, 2011). In this study, InVEST is applied to quantify ecosystem services of stormwater runoff reduction,

stormwater purification and carbon storage for the following two reasons. First, the required data to run InVEST for the City of Corvallis, OR are accessible through different sources (see Appendix II). Second, InVEST was developed and calibrated by Stanford University using data collected from the Willamette Valley Watershed, within which Corvallis is located. The specific models used in this study are the InVEST stormwater yield model, the InVEST purification model and the InVEST carbon storage model. The following picture shows the research flow chart.



## 5. Results

The ecosystem service quantification results for the different areas in 2000 and 2020 are summarized in the following table.

2000 Scenario							
	Area (m <sup>2</sup> )	Water Yield (m3)	N Retention (kg)	N Export (kg)	P Retention (kg)	P Export (kg)	Carbon (Mg)
Urban Condition	38,147,772.00	27,454,244.00	15,210.00	3,194.00	2,042.00	405.00	259,641.00
Urban Fringe	33,164,041.00	24,847,439.00	16,503.00	2,296.00	2,326.00	282.00	372,006.00
Urban Growth Boundary	71,311,813.00	52,301,683.00	31,713.00	5,490.00	4,368.00	687.00	631,647.00
Area outside of UGB	44,937,479.00	41,148,809.00	17,623.00	873.00	1,213.00	108.00	1,560,277.95
Stormbasin	116,249,292.00	93,450,492.00	49,336.00	6,363.00	5,581.00	795.00	2,191,924.95
2020 Scenario							
	Area (m <sup>2</sup> )	Water Yield (m3)	N Retention (kg)	N Export (kg)	P Retention (kg)	P Export (kg)	Carbon (Mg)
Urban Condition	38,147,772.00	26,727,005.16	16,121.88	4,608.23	2,934.57	1,029.71	164,316.68
Urban Fringe	33,164,041.00	24,939,651.42	17,901.81	4,432.94	3,377.53	948.48	148,669.90
Urban Growth Boundary	71,311,813.00	51,666,656.58	34,023.69	9,041.17	6,312.10	1,978.19	312,986.58
Area outside of UGB	44,937,479.00	41,160,292.65	20,094.55	878.88	2,052.13	109.01	1,561,261.74
Stormbasin	116,249,292.00	92,826,949.23	54,118.24	9,920.05	8,364.23	2,087.20	1,874,248.32

The ecosystem service quantification results for the different areas are summarized in the following table. From the table, it is showed that the whole stormbasin stored 2,191,924.95 tons carbon in 2000, however it is predicted to drop by 14.50% to 1,874,248.32 tons in 2020. The wateryield form the whole stormbasin remains almost the same, however the amount of nitrogen in the stormwater increases by 55.90% from 6363.00 kg to 9920.05 kg; and the amount of phosphorus soars by 162.54% from 795.00 kg to 2087.20 kg. Compared with the Area within the City Limit and the Area outside the Urban Growth Boundary, this research proves that the ecosystem service provided by the Area between the City Limit and the Urban Growth Boundary (Urban Fringe) is affected most by the urbanization in both terms of stormwater purification and carbon storage. The amount of carbon stored in the Urban Fringe drops most by 60.22%. The nitrogen and phosphorus exported from the Urban Fringe increase by 48.21% and 31.14% respectively.

## Reference

1. Allen, R. et al, 1998. Crop evapotranspiration. Guidelines for computing crop water requirements." FAO Irrigation and Drainage Paper 56. Food and Agriculture Organization of the United Nations, Rome, Italy.
2. Anderson, H., 1999 Use and implementation of urban growth boundaries. An analysis prepared by the center for regional and neighborhood action. 1999.
3. Bengston, D. et al. 2003. Public policies for managing urban growth and protecting open space: policy instruments and lessons learned in the United States.
4. Brilly. M et al, 2006. Monitoring the impact of urbanization on the Glinscica stream. Physics and Chemistry of the Earth. Volume 31. 2006
5. Brody. S, 1991. Review of Growth Management Strategies Used in Other States. Prepared for Oregon Department of Land Conservation and Development.
6. Cathcart, J. et al. 2006. Carbon storage and Oregon's land-use planning program. Silviculture 2006.
7. Chamberlain, J., and Miller, S., 2012. Policy incentives for switchgrass production using valuation of non-market ecosystem services. Energy Policy 48 (2012).
8. Cho, S. et al. 2008. Spatial analysis of the amenity value of green open space, Ecological Economics. 2008.
9. City of Corvallis, 2014. City of Corvallis Land Development Code.
10. City of Corvallis, 1998. The Corvallis 2020 Vision Statement.

11. City of Corvallis, 2002. Stormwater Master Plan.
12. CNN, 2008. 100 best places to live and launch 2008.
13. Conte, M. et al, 2011. Terrestrial carbon sequestration and storage. Natural Capital theory and practice of mapping ecosystem services. Kareiva et al, Oxford University Press. New York 2011.
14. Costanza, R., et al, 1997. The value of the world's ecosystem services and natural capital. Nature Volume 387. 1997.
15. Dawkins, C. and Nelson, A., 2002. Urban Containment Policies and Housing Prices: An International Comparison with Implications for Future Research. Land Use Policy. 2002.
16. Donohue, R. et al, 2012. Roots, storms and soil pores: Incorporating key ecohydrological processes into Budyko's hydrological model, Journal of Hydrology, 436-437, 35-50.
17. Free Association Design, 2009. Urban Gris #3: Rare Views of the Distinct Edge.  
<https://freeassociationdesign.wordpress.com/2009/11/25/urban-grids-3-rare-views-of-the-distinct-edge/> Accessed on Nov 11 2015.
18. Gibbs, H. et al. 2007. Monitoring and estimating tropical forest carbon stocks: making REDD a reality.
19. Goonetilleke, A., et al, 2005. Understanding the role of land use in urban stormwater quality management. Journal of Environmental Management. Volume 74. 2005.
20. Howe, D., 1991. Review of Growth Management Strategies Used in Other States. Prepared for Oregon Department of Land Conservation and Development.
21. Dempsey, J and Andrew, P. 2013. How well do urban growth boundaries contain development? Results for Oregon using a difference-in-difference estimator. Regional Science and Urban Economics. Volume 43, Issue 6.
22. Dupras et al (2014), Economic value of Greater Montreal's non-market ecosystem services in a land use management and planning perspective. The Canadian Geography. Volume 59, Issue 1, pages 93–106.
23. Faulkner, S., 2004. Urbanization impacts on the structure and function of forested wetlands. Urban Ecosystems 7 (2).
24. Fletcher, T. et al. 2007. Treatment efficiency of biofilters: results of a large scale biofilter column study. 13th International Rainwater Catchment Systems Conference and 5th International Water Sensitive Urban Design Conference, Sydney, Australia.
25. Frenkel, A., 2004. The potential effects of national growth-management policy on urban sprawl and the depletion of open spaces and farmland. Land Use Policy, 21 (4), pp 357-369.
26. Geoghegan, J. 2002. The value of open spaces in residential land use, Land Use Policy. 2002.
27. Gibbs, H. et al. 2007. Monitoring and estimating tropical forest carbon stocks: making REDD a reality.
28. Gordon, A. et al. 2009. Integrating conservation planning and landuse planning in urban landscapes. Landscape and Urban Planning 91(2009) 183-194.
29. Heldak, M and Raszka, B, 2012, Evaluation of the spatial policy of a commune with regards to planned land use. Environment Studies. Vol 22, 2013.
30. Irazábal, C. 2005. City Making and Urban Governance in the Americas Curitiba and Portland.
31. Jansson, A. and Colding, J. Tradeoffs between environmental goals and urban development: the case of nitrogen load from the Stockholm County to the Baltic Sea. Ambio 36. 2007.

32. Kline, J. and Alig, R., 1999. Does land use planning slow the conversion of forest and farm lands? *Growth and Change*. Vol. 30. 1999.
33. Knaap, G. and Nelson, A., 1988. The Effects of Regional Land Use Control in Oregon: A Theoretical and Empirical Review. *The Review of Regional Studies*. 1988.
34. Lillydahl, H. and Singell, D., 1987. The effects of growth management on the housing market: A review of the theoretical and empirical evidence. *Journal of Urban Affairs*, 1987.
35. Liu, C. and Li, X. 2012. Carbon storage and sequestration by urban forests in Shenyang, China. *Urban Forestry & Urban Greening*, Vol 11, 2012.
36. Liu, Y. et al. 2013, Identifying priority areas for the conservation of ecosystem services using GIS-based multicriteria evaluation. *Polish Journal of Ecology*, Vol 61, 2013.
37. Mathur, S., 2013. Impact of urban growth boundary on housing and land prices: evidence from King County, Washington, *Housing Studies*, 2013.
38. McKenzie, E. et al. 2011, Incorporating ecosystem services in decisions. *Natural capital: Theory and practice of mapping ecosystem services*. Oxford University Press, Oxford. 2011.
39. Mendoza, G. et al, 2011. Water supply as an ecosystem service for hydropower and irrigation. *Natural capital: Theory and practice of mapping ecosystem services*. Oxford University Press, Oxford. 2011.
40. Nelson, A., 1992. Preserving prime farmland in the face of urbanization: lessons from Oregon, *Journal of the American Planning Association*, 1992.
41. Nelson, A. and Moore, T., 1993. Assessing urban growth management: the case of Portland, Oregon, the USA's largest urban growth boundary. *Land Use Policy*. Volume 10, Issue 4. 1993.
42. Nirupama, N. and Simonovic, S., 2006. Increase of flood risk due to urbanization: A Canadian Example. *Natural Hazards*. 2007.
43. Oregon Department of Land Conservation and Development, <http://www.oregon.gov/LCD/Pages/goals.aspx>. Accessed on Nov 3, 2014.
44. Peng, C, et al. 2004. Urbanization and the Impact on Health and Environment: A Tale of Two Cities. *Urban Transformation in China*. Burlington, VT: Ashgate, Chapter 15, pp. 325-350.
45. Pollock, P, 2008. *Urban Growth Management Strategies, Sustainable Community Development Code Research Monologue Series Urban Form, Transportation*, the Rocky Mountain Land Use Institute.
46. Porter, D.R., 1997. *Managing Growth in America's Communities*. Island Press, Washington, DC.
47. Reckhow, K., 1980, *Modeling Phosphorus loading and lake response under uncertainty: A manual and compilation of export coefficients*. U.S. Environmental Protection Agency, Washington, D.C.
48. Robinson, L., 2005. Twenty-five years of sprawl in the Seattle region: growth management responses and implications for conservation, *Landscape and urban planning*, 2005.
49. Rose, S. and Peters, N., 2001. Effects of urbanization on streamflow in the Atlanta area (Georgia, USA): a comparative hydrological approach. *Hydrological Processes*, 2001.
50. Schaffler, A. and Swilling, M., 2012. Valuing green infrastructure in an urban environment under pressure — The Johannesburg case. *Ecological Economics* 2012.
51. Seo, W. & von Rabenau, B. 2011. Spatial impacts of microneighborhood physical disorder on property resale values in Columbus, Ohio, *Journal of Urban Planning and Development*. 2011



52. Sharp, R., et al 2014. InVEST tip user's guide: intergrated valuation of environmental services and tradeoffs.
53. State of Oregon, 2010, Land Conservation Act (LCA).
54. Wang, S. et al. 2002, Urbanization and Its Impacts on Water Environment in Tumen River Basin, Chinese Geographical Science. Volume 12. 2002.
55. Williams, D. "Global Urban Growth." Library of Congress Cataloging-in-Publication Data. 2012. Page 44.
56. U.S. Census Bureau, 2011. 2010 Census Redistricting Data U.S. FactFinder.
57. U.S. Census Bureau, 2014, Population Estimates.  
<http://www.census.gov/popest/data/index.html> Accessed Oct 12, 2015.
58. United States Census Bureau, 2010. US Gazetteer files 2010.
59. United Nations, 2014. Department of Economic and Social Affairs, Population Division World Urbanization Prospects: The 2014 Revision, Highlights.
60. United Nations Population Fund, 2015. Urbanization Overview.
61. Vigerstol, K and Aukema, J, 2011. A comparison of tools for modeling freshwater ecosystem services, *Journal of Environmental Management*, 2011.
62. Villa, F, et al. 2014, A Methodology for Adaptable and Robust Ecosystem Services Assessment, *PLoS One*, 2014; 9(3).
63. Yang, et al. 2012, Modeling hydrological ecosystem services and tradeoffs: a case study in Baiyangdian watershed, China. *Environmental Earth Sciences*, 2012.
64. Zhang, L. et al, 2004. A rational function approach for estimating mean annual evapotranspiration. *Water Resources Research*. Vol. 40 (2)
65. Zhou, K et al. 2014. Urban dynamics, landscape ecological security, and policy implications: A case study from the Wuhan area of central China. *Cities*. Volume 41, Part A, December 2014, Pages 141–153.



COUNCIL OF EDUCATORS  
IN LANDSCAPE ARCHITECTURE

A CELA Conference Presentation

Abstract ID: 189

## ANTICIPATORY PRESERVATION PLANNING: PROTECTING RURAL CULTURAL AND PHYSICAL LANDSCAPES

**FISHER, DOMINIC L.**

Assistant Professor of Landscape Architecture, North Dakota State University, [Dominic.fischer@ndsu.edu](mailto:Dominic.fischer@ndsu.edu)

**FISHER, HEATHER**

Lecturer of Architecture and Landscape Architecture, North Dakota State University,  
[Heather.fischer@ndsu.edu](mailto:Heather.fischer@ndsu.edu)

### 1 ABSTRACT

*The development trends of rural towns near natural resource extraction often lack a clear planning process or community input. This paper discusses a proposed preservation planning method by which the physical, cultural, and historic content of the town are conserved through the boom, bust and recovery cycle. Furthermore, it shows how critical thresholds of disturbance can be identified at the state level and guide individual communities to start the heritage preservation process at the local level.*

*This study's focus is the Bakken Oil formation, which stretches 200,000 square miles through portions of Montana, North Dakota, Saskatchewan, and Manitoba; its development underlines an arc of physical implications (flaring of thousands of oil and gas wells) that can be seen from space, but little has been done to prepare rural communities for the surge of growth associated with the burgeoning workforce and subsequent drop as oil prices fluctuate.*

*This paper illustrates a collaborative process where the growth and development of rural communities can focus on the tangible (quantifiable) built environment (via multi-scale geospatial analysis) while balancing the socio-cultural qualities of agrarian heritage (via local value assessment interviews). The genius loci of rural towns should be considered during the city planning process. Cultures of seemingly analogous rural landscapes have varied forms of social, cultural and economic activity. The disparate and often extant cultures serve as resources for mobilizing conditions for planning, appropriate public policy, and heritage preservation to strengthen the physical and cultural landscapes of regions affected by rapid change.*

*The heritage preservation-planning process was developed as the result of this mixed-method and multi-disciplinary analysis. Richardton, North Dakota serves as the case study to map the findings of the Heritage Planning process. The downward turn in oil prices has hastened the importance of preservation planning following this process to provide rural communities on the threshold of critical disturbance with the guidance necessary to utilize new and existing resources for a sustained legacy model of development.*

### 1.1 Keywords

Quality of Life, Public Policy, Community Engaged Process, Historic Preservation, Behavioral Impacts of the Environment.

---

The authors are solely responsible for the content of this technical presentation. The technical presentation does not necessarily reflect the official position of the Council of Educators in Landscape Architecture (CELA), and its printing and distribution does not constitute an endorsement of views which may be expressed. Technical presentations are not subject to the formal peer review process by CELA Track Chair System; therefore, they are not to be presented as peer-reviewed publications. Citation of this work should state that it is from a CELA conference paper. EXAMPLE: Author's Last Name, Initials. 2014. Title of Presentation. CELA Paper No. 14-xxxx. Baltimore, Maryland: CELA. For information about securing permission to reprint or reproduce a technical presentation, please contact CELA at [dsolco@uta.edu](mailto:dsolco@uta.edu) or 817-272-2321.

## **2 INTRODUCTION**

Rural communities in western North Dakota were once quiet agrarian landscapes beckoning a slow pace and simplicity of daily rituals and values. Townships consisted of scattershot homesteads and resilient town centers placed along the gravel roads and asphalt county roads of Thomas Jefferson's Rectangular Survey Grid System. The land blanketed with golden wheat, flax, and, further west, grazing cattle, sheep, goats, and bison. In 2008, with the marriage of hydraulic fracturing (fracking) and horizontal drilling, the landscape quickly sprouted with oil wells, tankers, and campers while rural roads that once were home to an occasional combine, tractor, or rake are now saturated with semi-trucks delivering goods for oil development. Today towns are experiencing an unprecedented surge in population. Reactive and sprawling development coupled with demolition of civic and cultural institutions along main streets have destabilized the cultural identity and characteristics of many rural towns. These communities have been unable to sustain their heritage, legacy and normal way of life. The rural cultural landscapes<sup>i</sup> are being collaterally erased or eroded by the mineral extraction industry (www.nps.gov 1994).

Anticipating when housing and other infrastructure development pressures will occur is difficult and communities often develop in a reactionary growth model. In this paper we outline a multidisciplinary approach to preservation planning. We begin with the use of geo-spatial analysis tools for macro-scale maps that utilize public data to identify communities at the threshold of physical disturbances from natural resource development. The results provide a starting point for communities to self-assess their needs by laying out a process for preservation planning in similarly impacted areas. Local Value Assessment interviews provided the framework for charting the heritage preservation process.

The process outlined in this paper will guide communities developing a heritage preservation plan by providing a clearer decision-making process and access to professional

services and resources. Rural towns can flourish from the immediacy of boomtown growth while looking long-term at the culture, character, and heritage of their community. Recommendations include following a preservation process chart that guides allocating economic gains set aside in trust funds from the oil industry and from existing sources.

Historic preservation began as a grassroots call to action. According to the National Park Service one of the key features is coordination with other planning efforts in the state, federal, and local land-use plans. Complex and often outdated land-use plans rarely account for the existence of valued historic and cultural resources. By incorporating historic preservation into broader public policy, land-use planning and decision-making arenas, communities can ensure the integration of historic resources (www.nps.gov 2011). Including a Heritage Preservation Plan as a component to the city's Comprehensive Plan, allows city officials and citizens to make informed decisions about the use of heritage resources that support city planning efforts.

Currently, the National Park Service defines historic preservation planning as the following:

*“Preservation planning establishes a future direction or vision for historic and cultural resource preservation, and establishes and promotes specific ways to achieve that vision in a clear, concise fashion appropriate to its audience.”*

This paper identifies key factors that contribute to the cultural and physical disruption of rural communities through GIS mapping. Detecting workforce housing and industry growth patterns and proximity of oil development will identify towns on the fringe of oil play. While we focused on towns at key thresholds of development, the preservation planning process can be applied at different stages of growth or decline. By forecasting coefficients of oil industry growth on rural landscapes, cities can anticipate and prepare for boomtown disturbances. Identification of these cities at the state level could activate the heritage preservation planning process. This paper

describes how to identify these cities, how the planning process is activated and by who. The following plan is intended to serve three basic functions through the five focused recommendations. The first is to create a platform for balanced discourse for stakeholders and officials during the local decision-making process for identifying which physical resources are encouraged for preservation planning. The second is to recommend planning policies at the local, county and state level. Lastly, linking subsequent projects to resource allocations at the appropriate level, and educating and connecting communities to consultants to see the newly illustrated process is completed. For this study we use Richardton, ND as a case study for deploying the heritage preservation process.

The town of Richardton, population 524, was founded in 1883 as a result of the Northern Pacific Railroad's western expansion. Like many rural cultural landscapes, it has experienced the devastation of fire, depression, coal boom and bust, and the outmigration of recent agrarian generations. The physical and spiritual presence of Assumption Abbey (see Figure 7), completed in 1910, and Sacred Heart Priory (1960) provides this rural community with distinctive cultural and social resources uncommon in many communities of this size (see Figure 5). The rise and fall through the cycles of development can be attributed to the dedication and devotion from long-term residents in this rural community embracing the challenges of each generation.

Richardton is facing the greatest threat to its unique character and identity from development related to oil and gas industries. Private stakeholders have invested interest in new growth along County Road 8 with resistance to the investing constraints along Main Street. The main street is composed of a dwindling stock of abandoned buildings—banks, grocers, drugstore; however, within the last few years, a new convenience store and grocery store have been built immediately off the Interstate 94 exit, well south of Richardton's town center. An ethanol plant can

be seen looming to the east behind a deserted barn and a Halliburton sand plant is currently under construction. These pre-existing factors make Richardton an exemplar case study for illustrating the heritage preservation process.

### **3 REVIEW OF OIL EXTRACTION IN NORTH DAKOTA**

The Williston Basin is a roughly circular depression, approximately 200,000 square miles in area, and lies 5,000 feet beneath part of Manitoba, North Dakota, South Dakota, Montana, and Saskatchewan. The massive oil shale deposits are the largest oil resource in the continental United States. The hypocenter of the boom is underneath Williston, ND.

Current development of the petroleum sector in the Williston Basin started in the mid-2000s when the marriage of horizontal drilling and hydraulic fracturing coincided with the high price of oil made it economically viable to extract unconventional (i.e. shale) oil from the Bakken formation. At the current rate there are 2,000 wells entering production annually, although this number has recently tapered due to the drop in oil prices. The counties within the Williston Basin are predominantly rural and the impact of hyper-resource extraction has prompted unprecedented economic and population growth.

The main layers of shale oil are located approximately 2 miles beneath Western North Dakota. Currently a large majority of oil producing wells, (about 95%) are extracting from the Bakken Formation. However, the Three Forks formation has been determined to be just as promising of an oil deposit and is currently being targeted. The U.S. Geological Survey calls the Bakken/Three Forks formation the largest continuous oil accumulation ever assessed in the U.S.

Economically, extraction of unconventional oil plays depends on available technology and prices of oil. In 1995, the USGS estimated that the Bakken formation contained about 150 million

barrels of oil. In 2008, based on new insights from horizontal drilling, the agency increased the estimates to 4 billion barrels.

The cumulative oil production from the Bakken recently surpassed 1 billion barrels from North Dakota and Montana. The U.S. Geological Survey said in 2013 the Bakken and underlying Three Forks formations have up to 11.4 billion barrels of oil that is recoverable with today's technology. These recent discoveries and advancement in fracking technologies led to disruptive growth in local communities.

### **3.1 Geospatial Analysis for Identifying Areas of Critical Disturbance**

The impacts of oil development can be direct and immediate such as the building of well pad and support areas, access roads, water handling facilities and workforce housing. Indirect impacts are not as obvious and thus are more difficult to quantify and map. The rate of growth has resulted in a boomtown atmosphere in many rural communities. Unfortunately, many of these areas were unprepared for such significant shifts in population and physical and cultural infrastructure requirements. The demographic history of the region results in unique challenges for these communities. Until 2010, North Dakota had been experiencing out-migration since the 1930s. The Buffalo Commons<sup>ii</sup> movement was one result. Geographic isolation of communities means no urban center to absorb workers (Great Plains Restoration Council 2015). Homogeneous social and cultural infrastructure makes it difficult for communities to take in a rapid influx of diverse worker populations. The absence of well-developed local infrastructure and governance, schools, medical facilities, law enforcement, recreation facilities, and so on increase the potential of severe impacts, at least during the early stages of growth. Had an interdisciplinary process for identifying and preserving critical areas been in place perhaps stronger and more efficient forms of development would have taken place. Appropriate targets for the heritage preservation planning process begins

with mapping oil development to anticipate growth areas by using oilrig, oil well and oil permitting data with ArcGIS software.

ArcGIS software is able to analyze a set of database design specifications through thematic raster-based layers, such as land use/land cover, elevation, topographic position, human disturbance (e.g. distance from roads, road density, housing density), or other relevant data. This study began by collecting well density and workforce housing data per county to analyze at which thresholds communities began to see significant disturbances to their cultural and physical infrastructure. Using this data and a suitability threshold that ranks both density of oil development and workforce housing units per county, we created a proximity buffer layer to target towns that were on the fringes of areas impacted by oil development. While any town within these development boundaries could benefit from following this preservation process, we focused this study on towns that were likely to be affected by future growth. This model is intended to provide a template for other areas of oil and gas development that wish to anticipate physical disturbance and highlight critical need for the heritage preservation planning process.

Geographic information collected for this study included county population data, rig and well geo-data, workforce housing unit and population data and road and town boundary data. This data is publically accessible (i.e. viewable) but in order to analyze it the meta-data must be downloaded from the North Dakota Industrial Commission, Department of Mineral Resources, Oil and Gas Division, home page ([dmr.nd.gov](http://dmr.nd.gov)) as a shape (.shp) file. Using these vector-based GIS maps we were able to create visualizations for among other things, the different ranges of oil development in the Bakken region based first on the density of active wells (see Figure 1 and Figure 2). This gave us a general sense of which counties remained within the Bakken oil play, but were less developed than others. Next we mapped the locations and sizes of workforce housing in the



region base on the total number of units and created 4 ranges of 20-mile proximity buffers with thresholds from 1 unit built up to 160 units (see Figure 3) to determine areas of greatest and least disturbance.

Removing the highest level of development, to determine the threshold for critical fringe areas yet to be affected, we identified only those towns that intersected oil well development at a density less than .22 wells per square mile and the proximity of workforce housing at a threshold of 31-55 units. The results of these overlays yielded 35 towns (see Figure 4) in an 8,401 square mile area, or approximately 30% of the active drilling area. This boundary is effectively the threshold for fringe communities and a starting place for communities in need of establishing a preservation plan.

**Figure 1. Active oil wells per square acres in affected counties. Source: Authors.**

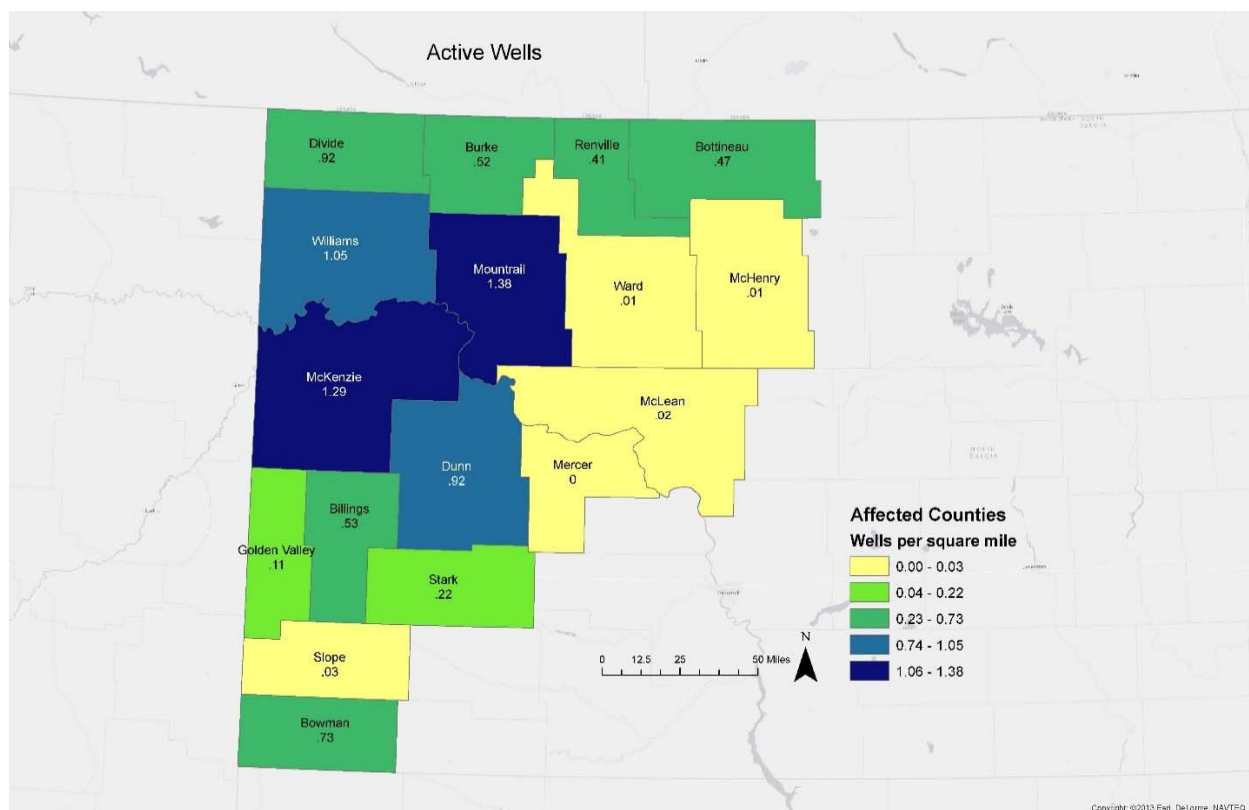


Figure 2. Active wells and density in counties per square mile. Source: Authors.

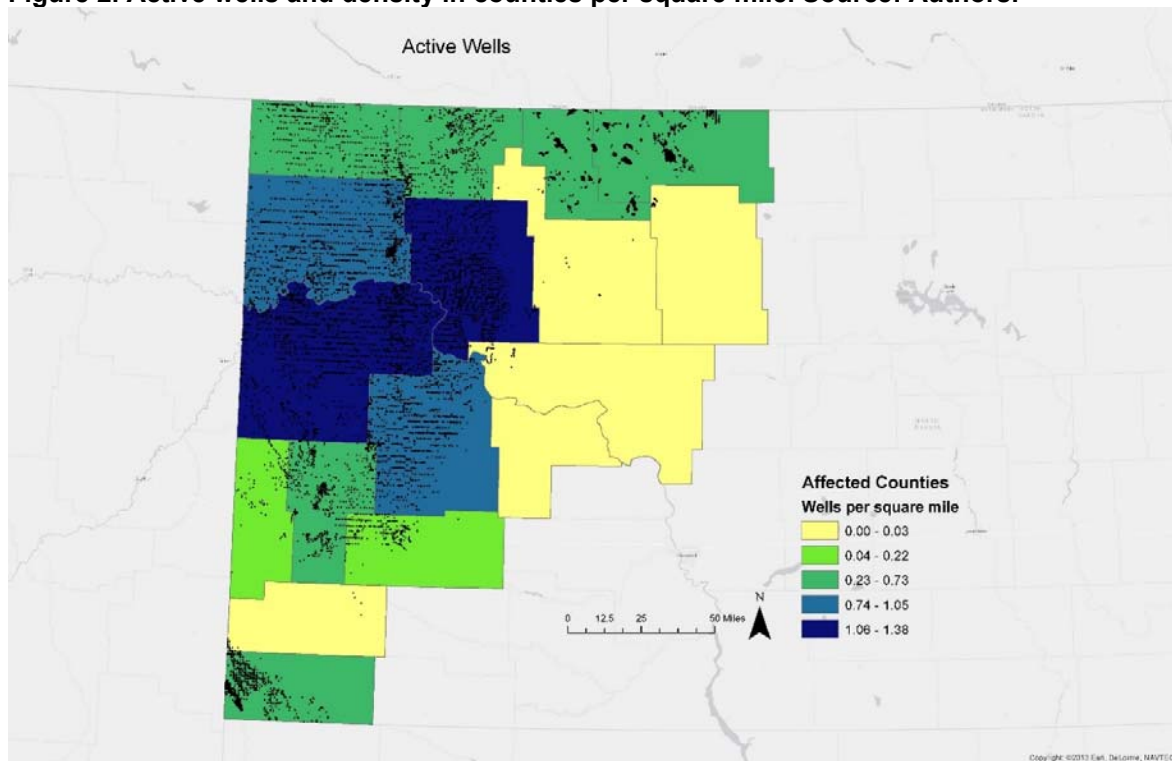
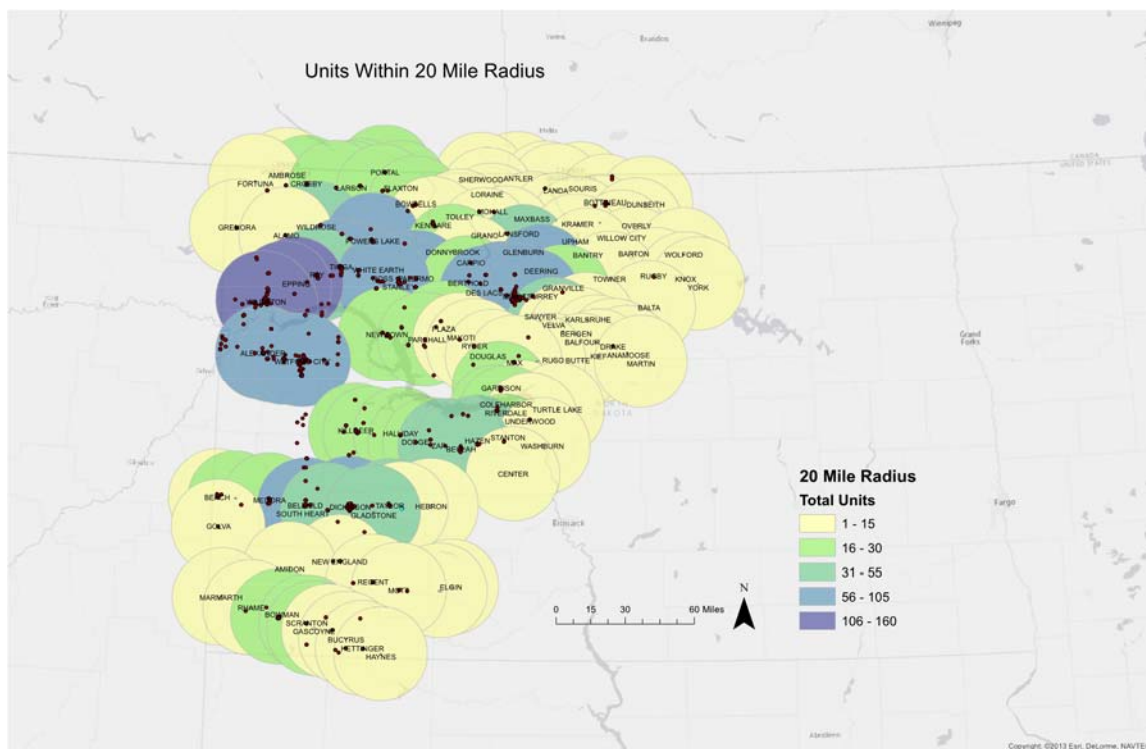
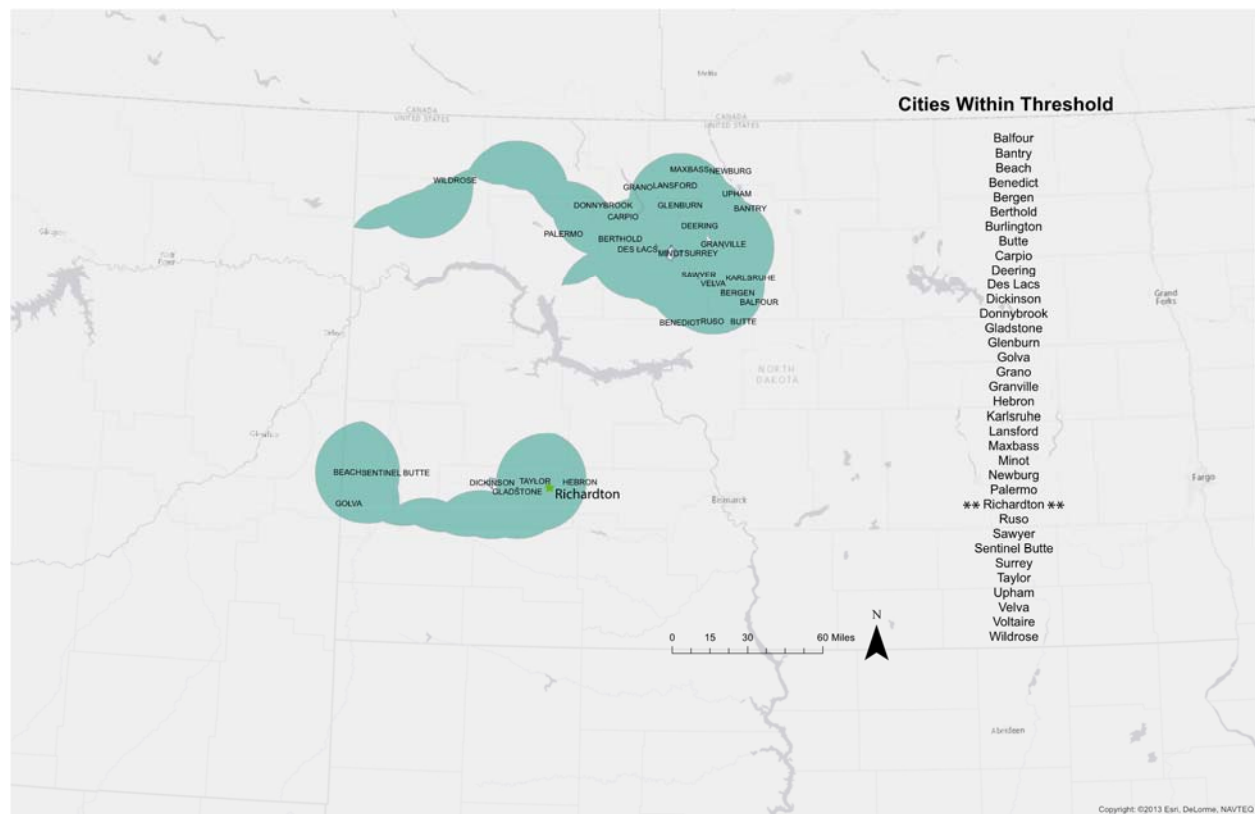


Figure 3. Workforce housing impact buffer analysis. Source: Authors.



**Figure 4. Threshold communities identified. Source: Authors.**



#### **4 Federal/State/Local Preservation Resources**

The state of North Dakota has billions of dollars in surplus but distribution to rural communities is severely underfunded. State fiscal policies are lagging behind the oil boom. Most of the oil and gas taxes are earmarked for the counties to distribute. The majority of funds are given to Hub cities, which are 12,500+ in population. Senate Bill 2103, passed in February of 2015, earmarked \$10 million of \$1.1 billion bill for cities within eligible counties bordering the Oil Patch. In 2013, the Historic Preservation Fund Grant Program was cancelled due to a 5% reduction in annual appropriations from the Federal Government. This has created a challenging environment for both preservation and sustainable growth.

In 2008, then Governor John Hoeven, now a Republican U.S. Senator, created the Legacy Fund, with the support of the public and state political leaders, resulting from an unexpected

influx of revenue. “No one had their hands around” the distribution of the money, said Pam Sharp, director of the state Office of Management and Budget, which prompted discussions about the need to save oil and gas tax revenue (Smith 2013).

As of April 22, 2015, total deposits to the Legacy Fund were \$3,017,804,016.02. The principal and earnings of the Legacy Fund may not be expended until after June 30, 2017, and an expenditure of principal after that date requires a vote of at least two-thirds of the members elected to each house of the Legislative Assembly (The Office of North Dakota State Treasure 2015).

The direct and indirect impacts of the oil industry on these communities have become apparent through the deterioration of historical built fabric. Earmarking a State Historical Fund from the Legacy Fund in which grant funds are provided to eligible local governments would position the state to benefit and support rural communities. By allocating tax revenue toward rural communities affected by industry growth, the funds would facilitate restoration and rehabilitation of historic buildings, preservation planning studies, and education programs.

The previous resource allocations will take time, years, in order to meet legislature and public approval. Municipal governments feeling the immediate pressure of growth in response to oil development may find it advantageous to provide tax increment financing to local investors. Initiating a local Renaissance Zone would provide incentives to encourage local investors in downtown properties. Owners who invest in qualified projects will be provided with both property tax and income tax incentives.

## **5 Methodology**

It is recommended that the state conduct the initial study pinpointing threshold communities outlined in the preceding geospatial analysis section. Once a threshold community

has been identified, such as Richardton, the state would notify governing bodies within each city. If a city were interested in a preservation planning project the state would recommend following the Preservation Process chart to follow (see Figure 6). It would be recommended that a town's city planner or administrator guide the process or a preservation or allied professional consultant be hired. The method for information gathering is through a local values assessment and a heritage (resource) interview. The local values assessment could be conducted at the local level through town hall meetings. These assessments would provide focused criteria for identifying prioritized resources for community stakeholders.

## **6 Application for Richardton, North Dakota**

Richardton's population followed the same trajectory as most other small North Dakota towns from the 1930s until early 2010. Visible signs of age and neglect are still evident in the broken teeth of Main Street's historic buildings. Abandoned houses, commercial and industrial properties coupled with insufficient municipal financial support lead to the deterioration of Richardton's physical identity. Vacant buildings have challenged repurposing empty parcels of land while limiting infill of developable land. Aging infrastructure and public facilities created financial burdens for a city that was struggling with lower tax revenues, a consequence of a declining population. The main historic commercial corridor along Highway 10 has experienced significant vacancy; historic buildings have been lost by fire or have been victims of "demolition by neglect." The following five focused recommendations provided guidance for implementing the heritage preservation planning case study of Richardton, ND.

This plan is intended to encourage preservation by the owner, as primary stakeholder to these properties, through local, county and state incentives. The city's role is to encourage the plan by providing information, guidance, technical support, and incentives to private property

owners. The county's role is to coordinate preservation partnerships with municipalities and state agencies and organizations, while promoting public awareness for historic preservation and creating livable, sustainable and healthy communities. Finally, at the state level, the State Historic Preservation Officers (SHPOs), appointed by the Governor, supports the Federal Historic Preservation Program, while creating programs specific to the cultural identity within their state. The following plan is intended to serve three basic functions through the five focused recommendations. The first is to create a platform for balanced discourse for stakeholder and officials during the local decision-making process for identifying which physical resources are encouraged for preservation planning. The second is to recommend planning policies at the local, county and state level. Lastly, linking subsequent projects to resource allocations at the appropriate level, and educating and connecting communities to consultants to see the newly illustrated process is completed.

## **7 Application for Richardton, North Dakota**

Richardton's population followed the same trajectory as most other small North Dakota towns from the 1930s until early 2010. Visible signs of age and neglect are still evident in the broken teeth of Main Street's historic buildings. Abandoned houses, commercial and industrial properties coupled with insufficient municipal financial support lead to the deterioration of Richardton's physical identity. Vacant buildings have challenged repurposing empty parcels of land while limiting infill of developable land. Aging infrastructure and public facilities created financial burdens for a city that was struggling with lower tax revenues, a consequence of a declining population. The main historic commercial corridor along Highway 10 has experienced significant vacancy; historic buildings have been lost by fire or have been victims of "demolition

by neglect.” The following five focused recommendations provided guidance for implementing the heritage preservation planning case study of Richardton, ND.

This plan is intended to encourage preservation by the owner, as primary stakeholder to these properties, through local, county and state incentives. The city’s role is to encourage the plan by providing information, guidance, technical support, and incentives to private property owners. The county’s role is to coordinate preservation partnerships with municipalities and state agencies and organizations, while promoting public awareness for historic preservation and creating livable, sustainable and healthy communities. Finally, at the state level, the State Historic Preservation Officers (SHPOs), appointed by the Governor, supports the Federal Historic Preservation Program, while creating programs specific to the cultural identity within their state. The following plan is intended to serve three basic functions through the five focused recommendations. The first is to create a platform for balanced discourse for stakeholder and officials during the local decision-making process for identifying which physical resources are encouraged for preservation planning. The second is to recommend planning policies at the local, county and state level. Lastly, linking subsequent projects to resource allocations at the appropriate level, and educating and connecting communities to consultants to see the newly illustrated process is completed.

## **8 Identifying Local Factors**

Citizens investing in the renewal of existing built heritage plays a significant role in the cultural, social and physical identity of their town. In 2005, Simon Thurley described heritage as being cyclical: “By understanding (cultural heritage), people value it. By valuing it, people want to care for it. By caring for it, it will help people enjoy it. From enjoying it, comes a thirst to understand. By understanding it...”

The local values assessment was conducted through a series of interviews with local citizens, entrepreneurs, historian, monks and leaders in the community of Richardton. In order to identify local values an assessment of the current context provided a benchmark for guidance to address long range needs and concerns specific to rural cultural landscapes. The immediate and potential demands of the energy development on Richardton are starting to take hold.

The lack of housing, and lifestyle options, is a significant concern to current and potential residents. Many oil workers have been situated in western North Dakota for over two years, which is the timeline necessary for approval of a home loan and are looking to build. “They are ready to move their families here and don’t want to be in oil country,” said Ambrose Hoff, Richardton, North Dakota, entrepreneur, “They’d rather be on the outside and drive in” (Hoff 2014).

The lack of housing has driven residential costs out of reach for many locals, causing further divisions within the population and an increase in homelessness. In Minot, 100 miles northeast of Richardton, some housing development have withdrawn from U.S. Department of Housing and Urban Development low-income programs in order to charge higher rents, says Minot Finance Director Cindy Hemphill (Holeywell 2011). The housing dilemma has left many communities facing a potential repeat of the disastrous 1980s when many cities were happy to assist developers fill the housing void by building infrastructure for new homes in hopes of accommodating new residents, while generating property tax revenue (Holeywell 2011). When oil prices dropped, nearly overnight, the industry pulled out and developers left having owed more in property taxes on undeveloped land than the value of the land itself.

Initially, drilling a new well creates 120 jobs, but maintaining the well only requires one person. “You don’t build for 100 percent (of the growth); you build for 20 percent,” says Gene



Veeder, who leads economic development in McKenzie County, the most active drilling county in the state (Holeywell 2011). The surge of population related to oil development will begin to slow in the next 10 to 20 years. North Dakota is now in its seventh year of the most recent industrial boom caused by Bakken shale extraction. The social fabric of towns like Williston, Watford City, and Dickinson has been swallowed by the siege a new transient population working in the oil fields. The sudden and unsustainable shift in physical, economic and social growth has contributed to the outmigration of many long-term residents.

Companies servicing the oil industry in adjacent counties are experiencing the over saturation of services centrally based within the Bakken. The new theme in servicing the demands of Bakken development is working from the perimeter in. New companies like Ross & Associates, Ltd., a design/build and general construction company, have established offices in Richardton due to the increasing demand for commercial construction of roads and buildings (Ross Associates Ltd. 2012).

“Main street is probably moving out here now (referring to highway lined development),” said Ambrose Hoff, “like every other city, unfortunately. We’d like it to be in town... but there’s no place downtown to put a facility like this,” referring to the new grocery store located off the interstate. “And there’s no parking,” John Gengler replied, a retired teacher and author. “In order for businesses around here to survive you need to have the interstate traffic,” said Hoff.” Gengler stated there was talk about building a community center along Main Street but the issue came back to, “where will people park?”

The city officials were referenced as being “cautiously conservative” toward development with the amount of legal paperwork along with expense has discouraged potential investors. The

city was offered a potential community center site downtown that was to be donated, but the city rejected the offer.

There has been a new wave of potential residents to the Richardton area. People who have come to work in the oil fields realized how demanding it is and are now applying for local companies outside of the oil industry. Ambrose Hoff saw the closure of a local manufacturing company, employing fifty people, as potential. He told the realtor of the manufacturing company, “You’ve taken enough out of our town and I’d like it to become something again,” which developed into Amber Waves—a company that makes hopper-bottom bins for grain and fertilizer, builds hopper tanks for frac-sand for the oil fields, cow-cake bins for cattle ranches and electronic circuit boards. Hoff’s oldest son, Jody, and a nephew, Doug Hauck, run the business of nearly 50 employees (Pates 2013).

In 1987 Hoff started Stone Mill Inc., a processing plant for garbanzos, soybeans, oats, rye, spring wheat and quinoa, which employs 15 workers. In 2005, Hoff and corn seed salesman Mark Erickson decided they should build an ethanol plant in Richardton. “We decided we’d propose it until we ran into problems and we never did, so we never quit,” Hoff says (Pates 2013). Red Trail Energy now produces 60 million gallons of ethanol per year and created 50 jobs.

It had been seven years since Richardton’s only grocer closed its doors, so in 2013, Hoff and his daughter built the 10,000-square-foot Springfield Market; not your average rural grocer. It is a full-service market with a bakery and deli supplying 23 jobs for the local community. A year earlier Dickinson was the closest grocery store (30-miles away), and now Dickinson residents are driving to the Springfield Market to escape the saturated supermarkets of the big city for a small town grocer supplied with urban amenities. “I think in North Dakota, we have so

many people with ingenuity and creativity,” Hoff says. “I think that’s why we do so well for ourselves” (Pates 2013).

For the past 100 years, Richardton has been regionally famous for its Catholic abbey and German sausage, but the Bakken oil boom is on the western horizon. Town Mayor Frank Kirchenheiter referenced his community of 619, counted in 2010, as enjoying the trickle-down effect without being inundated but that is shifting (Donovan 2013). Historically Richardton has served as a bedroom community for Dickinson, 20 minutes away, but the new dwellers are shifting from families to oil field workers, five-guys-to-a-house. Recently, a few duplexes and homes were developed in town but the demand for housing remains.

Similar to many western rural communities, Kirchenheiter stated he wishes towns like his were more visible in the statewide oil development radar, “There’s no standing still,” he said. “We’re at a critical point. If we get through it, things will be better (Donovan 2013). The immediacy and strain to the 75-year-old sewer and lagoon cells add to the pressure to an already aged system, millions are needed to improve let alone grow. “We feel overlooked to some degree. We’re all overlooked in these small communities,” said Kirchenheiter (Donovan 2013).

Richardton faces a similar challenge of an aging infrastructure. The consequences of the previous coal boom and bust are evident along the rundown and neglected main street. Boarded-up storefronts, abandoned buildings, and underutilized lots have resulted in the dismal appearance of a feckless main street, unlike the uplifting social character of Richardton citizens.

Historically, modest industrial economic growth has sustained this town through past busts, but the windfall of the Bakken boom carries the greatest potential for growth. While many residents are eager for change, others are campaigning for development that is cautiously conservative.

## **9 Heritage (Physical) Resource Inventory and Analysis**

The ability of residents to recognize spatial and built forms derives from how they identify city forms. Just as sound ecological performance supports a healthy ecosystem, so should the city support the everyday performance of its residents through a resilient form. Identifying spatial characteristics and attributes associated with a place, or rural community, are distinguished through built forms: historically, barns, grain elevators, and main streets; increasingly, oil pump jacks, wind turbines, ethanol plants. These public spaces and forms create shared memories of the greater collective. The distinctiveness of recognizable features should invoke memories of past events as it affects their life and contributes to the meaning of the place through time, and foster new ones.

If a town is considering the implementation of preservation planning parallel with the growth plan a series of identifying questions just be asked during public meetings. These questions lead to the establishing a process of priorities within the physical and spatial form of a town. These questions were asked of Richardton, North Dakota citizens to provide focus of recognizable and important community institutions:

- “What is the town’s legacy?”
- “What are the past/present cultural traditions celebrated?”
- “What are the tangible built resources (e.g. buildings, groups of buildings, areas), and/or archaeological heritage (e.g. relics, object and human traces from past periods of history on the surface), that embody the built identity of the town?”
- “What historical fabric exists on Main Street?”
- “What are the unique identifiable forms of our city?”

- “What is the intangible heritage of the town (e.g. knowledge, skills, customs, beliefs and values)

In order to facilitate a focused dialogue of community residents, city officials, and planning professionals the following list, produced by in collaboration with a local preservation expert, *initiates* a direct discussion of basic community institutions to be examined:

- Churches
- Agriculture receiving distribution
- Schools
- Banks
- Retail stores
- Livable neighborhoods
  - Sidewalks
  - Boulevards
  - Street Trees
  - Alley
- Recreation and culture
  - Parks
  - Cemeteries
  - Band Shells
- Sustainable industries and job creating commercial ventures
- Communities events

This plan *identifies* which physical resources are advocated for preservation while providing a plan of the existing context.

**Figure 5. Richardton, North Dakota Heritage (physical) resource and analysis map. Source: Authors.**



## 10 Develop Vision and Goals: Create a platform for balanced discourse for stakeholders

There are existing constraints to a balanced discourse. Based on personal interviews, the consensus among stakeholders including local leaders, government agencies, policy makers, clergy, owners, community leaders and entrepreneur's remains divided between heritage and growth models for preservation, planning and development. The intentions of local entrepreneurs and most significant contributors toward developing economic and job growth focus on developing the town toward the highway-rather than seeing the future and significance toward investing in the cultural renewal of main street. Monks and other locals are interested in revivifying the town center but lack personal assets to do so, while the city officials remain conservatively cautious toward any substantial changes.

Collaboration among multi-stakeholders is becoming more significant as these diverse communities of people are interconnected. It is imperative to recognize stakeholders at the federal, state, and local/county levels. The federal stakeholders include: federal agencies (Core of Engineer, Environmental Protection Agency, Department of the Interior: National Park Service, Bureau of Land Management), nonprofits (National Trust, National Preservation Institute, Preservation Action), policy-makers (Legislators, Secretary of the Interior, lobbyists, political action group), and government officials. The state stakeholders include: legislators, policy-makers, government officials, state agencies (Oil & Mineral Industrial Development, Natural Resource Management, Fish and Wildlife services, State Historical Society, State Historic Preservation Office), nonprofits/advocacy groups (Preservation North Dakota, Prairie Church of North Dakota). The local/county stakeholders for Richardton include: landowners, residents, policy makers, schools/students, employers/employees, community volunteers, funders, and heads of business, contractors, developers, clergy, community leaders, local board members, and local/county government.

Communication among various stakeholders should be conducted through public meetings. The preservation planning process during development in rural landscape, like that of Richardton, must incorporate significant input from diverse perspectives within the community. An exclusive “closed and knowing” planning process will discourage local stakeholders from participating. While the state, county and local government should be at the table during the development phase, the decision-making process on prioritizing local resource allocation should be generated by locals and preservation professional. The heritage preservation planning process of rural cultural landscapes must be inclusive of all stakeholders while fostering a public discussion.

## **11 Take Inventory of Cultural Community Institutional Resources**

In order to pursue a sustainable process, all stakeholders should be considered during the physical and cultural inventory phase of the process. In the past, preservation was seen as the maintenance and protection of one building. Stakeholders should understand that the frame of cultural heritage preservation is widening to include larger spatial units, physical landscapes, and comprehensive evaluation of local cultural values as it pertains to Richardton. Identifiable forms that embody the town's legacy should categorize the community resources. The recommended strategy for classifying resources is through community engagement/feedback with focus given to civic buildings and space. The community of Richardton focused on agricultural receiving distribution, schools, banks, train depot, retail stores, grain elevators, recreation and culture (parks, cemeteries, band shells and ruins), sustainable industries, job creating commercial ventures providing opportunities for the next generation, and community events.

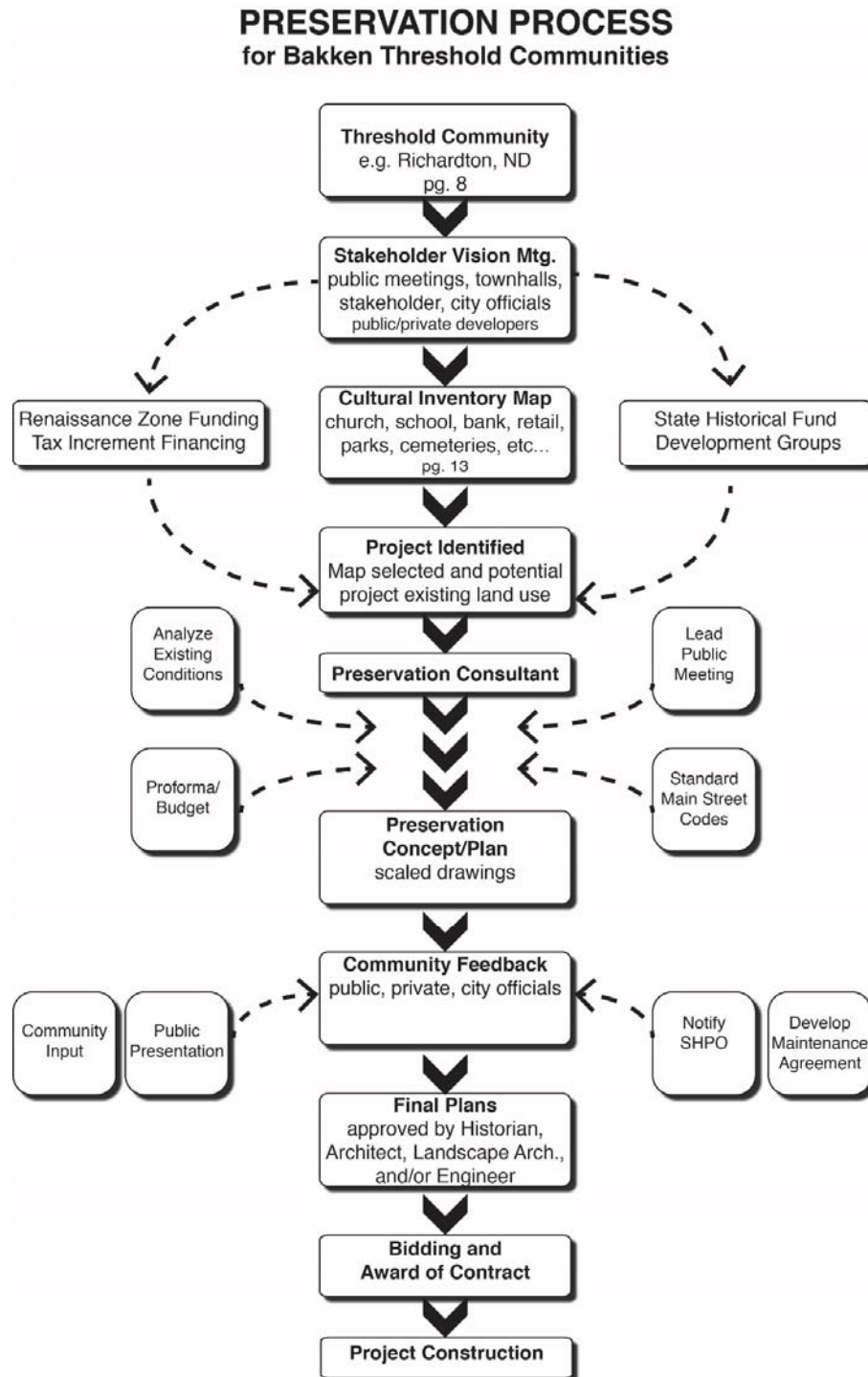
## **12 Educate and connect stakeholders with appropriate consultants and resource allocation**

Implementing a preservation-planning project may be daunting and confusing for local owners, but the charted process can encourage it. If a key stakeholder (owner) were intent on investing toward the renewal of historic fabric, the city would provide them with Heritage Preservation Chart (see Figure 6) as a tool. This will guide investors and interested publics through the local Heritage Preservation Plan process. The chart serves as recommendations for the key stakeholder. It will provide guidance toward what economic resources are available at the local, state, and federal level, who are the stakeholders, who are the consultants, advocacy groups, when community input is necessary, and finally through the final plans and construction of the project. The Heritage Preservation Chart, with further development, could be hosted on a



website for easier and updated links to the necessary resources for completing a preservation project.

**Figure 6. Heritage Preservation Process for Bakken Threshold Communities. Source: Authors.**



### 13 Mapping: Existing land and potential projects

Provide focus to preserve key buildings that fit the cultural and economic criteria. The community context map indicates cultural resources that fit cultural and economic criteria (see Figure 5). Although the current building collection fronting Richardton's Main Street has lost vitality and become disconnected from necessary daily activities, the existing building fabric provides potential opportunities that can be catalyzed by the historic preservation of key buildings. Assumption Abbey (see Figure 7) has set a unique precedent near boomtown growth; there is, however, a consistent threat to the Main Street.

Single use steel buildings of low investment have replaced historic buildings lost by fire or “demolition by neglect,” which contributes to the loss of local identity, value and pride in sense of place. By considering and providing culture and heritage as contributing factors during the local policy and decision making discourse and process—current and future residents may experience the importance of physical form. Culture and memory play a crucial role in the search for who we were, who we are, and who we will be tomorrow. Heritage frames sustainable development, environmental protection and renewing development by bringing built elements together.

**Figure 7. Assumption Abbey, constructed in 1910 (photo circa 2015). Source: Author.**



#### **14 Human Resources: Link advocacy groups to local/state policy-makers**

Many of these rural communities are in need of a “Call to action” for focus group interaction. An advocacy group may facilitate the anticipatory planning process of these rural communities through guidance of local policy-making, available economic resources, strategic planning and defining a sustainable decision-making process. It is often the case that these rural communities simply need a leader or group to initiate and support will follow. An advocacy group will provide the backbone to initiate such planning efforts and provide a platform of consensus seeking within the local community in order to guide local policy/decision-making. The group is meant to promote the importance of incorporating Heritage Preservation Planning as an integral piece of sustainable boomtown growth, while exerting influence through channels of public opinion campaigns and networking. It is imperative that all stakeholders, primary, key, or secondary, are represented through the policy/decision making process.

The State Historic Preservation Office (SHPO) may serve as a gateway for distributing resources to these communities. Also, the SHPO should direct municipalities, such as Richardton, interested in preservation planning to North Dakota League of Cities. The League, established in 1912, was organized to build a body of knowledge by sharing experiences with one another. It may serve as a platform for rural communities to encourage local leaders by providing educational opportunities and services to city officials. The coalition connects resources with needs, and represents the interests of municipalities in state and federal public policy discussions (North Dakota League of Cities 2014). Further resources, (i.e. webinars, educational materials, graphics, and GIS maps) should be provided to the League for more readily available distribution of preservation planning resources statewide. Rural areas and townships rarely have the financial, technical and staff resources available in order to respond to pressures of growth. The advocacy

group will encourage communities to work together in alliance to gain economic and community funding at the local, state and federal level.

## **15 Key Steps for Threshold Communities**

Other threshold communities may find assistance through design charettes by design departments at local universities or design professionals. These resources may provide assistance to the community without a planning professional on staff. The local stakeholder, city official, and professionals work together to identify a long-term preservation plan goals following the heritage preservation plan.

## **16 Conclusion**

Most rural communities want to maintain their rural character. The new challenge for many North Dakota rural communities is maintaining their rural character through boomtown growth while strengthening their local economy. The balance of this new growth must promote prosperity with long-term sustainability. Rural communities should identify planning strategies they are able to implement with resources available. Local governments should invest in main street leaders by providing financial incentives toward main street renewal. Investment in developing local interest and dependence in main street businesses shifts reliance from corporate patronage to secure the survival of small town lifestyle.

Livable communities can be observed by distinctive characteristics through the Heritage Preservation Planning model. Through this approach a successful livable town should foster a downtown core servicing their citizens with their local restaurant, retail, and civic functions. The main street is the core of the community that creates the identity and personality that set the tone to distinguish memories of that place. The city center is perceived through the legacy of roots experienced in the style of building and the layout of streets and public spaces. The current

community interests and pride is reflected in the development of amenities to attract people to that place.

Many of these rural towns began as a result of the railroad. The initial growth and development of these towns are along main street parallel to the railroad. This typically, provides a concentration of historic buildings and landscapes at these locations. Implementing preservation planning strategies organized around improving the quality of life for residents while keeping their rural values creates stability of main street. This growth will attract and support new opportunities for jobs and businesses. By investing in the growth and renewal of historic town centers and ensuring new growth and development reinforces traditional patterns, the rural community lifestyle may also be preserved while facilitating boomtown economic growth and opportunities.

Further time, research and case studies are needed to fill an existing gap in preservation research related to the effects of the recent phenomenon of horizontal fracking on rural communities. The rapid and unfettered growth will continue to impact rural communities for generations to come. Currently, a significant amount of preservation literature focuses on preservation related to urban areas, or suggesting “urban managers,” which is not relevant to these communities and the length of these studies often span years. Although the boom has been in full swing for the past five years, it still remains unpredictable, which contributes to the need of sequential research and case studies.

The most recent North Dakota boom of oil and natural gas development left cities like Watford City, Williston, and Dickinson struggling to keep up with the physical growth necessary to meet the growth in population. The reactive development consists of sprawling developments along the outer periphery, away from the civic core and characteristics main street once evoked.

The growth model of development has nearly erased the unique cultural identities and characteristic of each town, which inspired the investigation of how rural cultural landscapes, not yet affected by extraction development, may consider a valid method of anticipatory preservation planning through the growth of their communities.

The social factors of each rural community will never be duplicated. Applying general blanket social values to counties, region, or even states will stifle the cultural diversity of each town. It is imperative that time is spent understanding the development trends of that particular town throughout time. The present local identity, culture and values are equally important as past generations. The preservation professional must be aware of how locals view the opinions and recommendations from an “outsider.” Significant time must be spent within each community, speaking with a range of residents, and engaging them in conversations about their past, present and future visions of their community.

Located on the eastern fringe of Oil County, Richardton has already experienced signs of growth with an increase in residents, new grocer, ethanol plant, and construction businesses servicing the oil fields. The recommendations focus on communities anticipating the imminent growth of oil development but aware of the effects of reactionary growth on these rural landscape. A proactive municipality interested in preservation planning must recognize and prioritize properties common to the shared values, culture, and heritage through distinctive built features inherently preserve the individual identity of each town. Focusing on renewing and preserving the form of existing main street corridors and developing infill of existing infrastructure will minimize long-term cost, maintenance, and disruption. The unfettered growth of the early 1980’s boom left many rural towns with a large amount of property back in tax default. By focusing on revitalizing the historic town center, long-term costs savings will be

passed on to local governments through mitigating excessive immediate growth that has already strained other western town's ability to support through financing, public protection, and maintenance.

While the state of North Dakota's pockets run deep, immediate and direct funding is not readily available. The local pride in autonomy and municipal governance toward solving problems at the local level may be further supported through municipal financial support. Creating a Renaissance Zone to provide tax increment financing, property tax and income tax incentives for owners will encourage investment of deteriorating buildings and reverse further abandonment of Main Street.

Utilizing financial resources through the Legacy Fund provide potential long-term funding for these rural cultural landscapes. Richardton serves as an initial model for a heritage preservation-planning project in hopes that the successful application of anticipatory preservation planning for this rural community is recognized. By meeting the needs of growth while fostering the built heritage of each town, if successful, potential for a direct fund allocated for anticipatory preservation planning may be generated.

There are quiet murmurs reminiscent of former North Dakota governor, Art Link's 1973 message, "Land must be considered as more than a commodity to be bought, sold, and consumed. Rather it should be viewed as a finite resource to be constantly nourished" (Link 1973). This preservation process can be the first step. It is meant to (re)connect local residents of rural cultural landscapes based on Art Link's vision of cultivating our land (Link 1973). Rural communities on the verge of boomtown growth may realize the significant role built heritage has played through the cultural, social and physical identity of their town. Anticipatory preservation planning following the Heritage Preservation Process will provide rural communities on the

threshold of critical disturbance with the guidance necessary to utilize boomtown resources for a sustained legacy model of development.

## References

Donovan, Lauren. *Oil Boom Pressure Squeezes New life into Richardton*. May 25, 2013.

[http://bismarcktribune.com/bakken/oil-boom-pressure-squeezes-new-life-into-richardton/article\\_a78123ba-c5a4-11e2-8011-0019bb2963f4.html](http://bismarcktribune.com/bakken/oil-boom-pressure-squeezes-new-life-into-richardton/article_a78123ba-c5a4-11e2-8011-0019bb2963f4.html) (accessed April 21, 2014).

Hoff, Ambrose., interview by Heather Fischer. *Personal Interview* Richardton, ND, (March 29, 2014).

Holeywell, Ryan. *North Dakota's Oil Boom is a Blessing and a Curse*. August 2011.

<http://www.governing.com/topics/energy-env/north-dakotas-oil-boom-blessing-curse.html> (accessed April 21, 2014).

Great Plains Restoration Council. *Buffalo Commons*.

<http://gprc.org/research/buffalo-commons.html> (accessed July 9, 2015).

Link, Art. *Link Archival News Footage*. Bismarck, North Dakota, 1973.

Link, Art. *Link Archival News Footage*. Mandan, North Dakota, 1973.

National Park Service. *Preservation Briefs*. September 1994.

<http://www.nps.gov/tps/how-to-preserve/briefs/36-cultural-landscapes.htm#plan> (accessed April 17, 2014).

National Park Service. *Historic Preservation Planning Program*. May 6, 2011.

<http://www.nps.gov/history/hps/pad/index.htm> (accessed April 18, 2014).

North Dakota League of Cities. *About the League*. 2014.

<http://www.ndlc.org/index.aspx?NID=27> (accessed April 11, 2014).



The Office of North Dakota State Treasurer. *North Dakota Government Funds*. April 28, 2015.

<http://www.nd.gov/treasurer/north-dakota-government-funds/> (accessed May 21, 2015).

Pates, Mikkell. *The Ambrose Effect*. October 28, 2013.

<http://www.agweek.com/event/article/id/21955/> (accessed April 1, 2014).

Ross Associates Ltd. *News & Events*. September 25, 2012. <http://www.rosscm.com/news.asp>  
(accessed April 1, 2014).

Smith, Nick. *North Dakota Ready for a 'Rainy Day'*. August 11, 2013.

[http://bismarcktribune.com/news/local/govt-and-politics/north-dakota-ready-for-a-rainy-day/article\\_0a815d76-0133-11e3-9534-0019bb2963f4.html](http://bismarcktribune.com/news/local/govt-and-politics/north-dakota-ready-for-a-rainy-day/article_0a815d76-0133-11e3-9534-0019bb2963f4.html) (accessed March 19, 2014).

## BIO

### **Dominic L. Fischer**

Assistant Professor of Landscape Architecture, North Dakota State University.

Research interests in Environmental Planning and parallels to landscape architecture history in the Great Plains, social/cultural and physical infrastructure analysis as it relates to professional pedagogy and practice.

### **Heather Fischer**

Lecturer of Architecture and Landscape Architecture, North Dakota State University.

Research focusing on fundamentals of design and historic preservation in rural communities.

---

<sup>i</sup> (National Park Service 1994) A **cultural landscape** is defined as "a geographic area, including both cultural and natural resources and the wildlife or domestic animals therein, associated with a historic event, activity, or person or exhibiting other cultural or aesthetic values." There are four general types of cultural landscapes, not mutually exclusive: historic sites, historic designed landscapes, historic vernacular landscapes, and ethnographic landscapes. National Park Service. *Preservation Briefs*. September 1994. <http://www.nps.gov/tps/how-to-preserve/briefs/36-cultural-landscapes.htm#plan> (accessed April 17, 2014).

<sup>ii</sup> (Great Plains Restoration Council 2015) The Buffalo Commons is a cultural and social movement for positive, restorative social and ecological change on the Great Plains. *Buffalo Commons*. [http://gprc.org/research/buffalo-commons/#.VZ\\_3--c1Wgc](http://gprc.org/research/buffalo-commons/#.VZ_3--c1Wgc) (accessed July 9, 2015).



COUNCIL OF EDUCATORS  
IN LANDSCAPE ARCHITECTURE

*A CELA Conference Presentation*

**Abstract ID: 222**

## **THE SKETCH WALK: EXPLORATION, DISCOVERY AND A DISCUSSION OF PLACE**

**ALOMAR, RICHARD**

Assistant Professor, Rutgers University, Department of Landscape Architecture

### **ABSTRACT**

*The growth and popularity of urban sketching (Campanario, 2012), sketch walks and sketch crawls, has brought the practice of sketching to the attention of landscape architecture programs and practitioners (Richards, 2013). Both CELA and the ASLA have hosted sketch walks as an academic and practical form for groups to explore, discover and discuss place. This has initiated a discussion on the role of sketching, recording direct observations, mapping and social media sharing in the teaching of design.*

*The Sketch Walk, is an activity that mimics the skills required to experience and document space and initiate the process of analysis and conceptualization. The Sketch Walk can engage instructor, student and practitioner in an operation that contributes to the design of urban spaces. The roots of sketch walking will be discussed, from pre-photographic travelogues, and sketchbooks to the socio-political infusion of Situationist thinking (Debord, 1958), Psychogeographic explorations (Self & Steadman, 2007) and Physiocartographic mapping operations (Gilbert 2005-2007). A description of the planning and organization of a sketch walk and perspectives on the use of sketching, mapping and physical engagement in the landscape will be discussed.*

### **1.1 Keywords**

Sketching, Sketch Walk, Drawing, Mapping, Place, Cognition

### **1 SKETCHING**

The growth and popularity of sketching, has brought the practice of on-location sketching to the attention of landscape architecture programs and practitioners. Its popularity can be measured by the proliferation of books on Urban, On-Location and Landscape Sketching and the appearance of sketch organizations, like Urban Sketchers. A decade ago, sketching had been relegated to studio drawing, and the analysis and representation of landscape designs was developed through digital photography, video, and two and three dimensional graphic programs. *“Digital Drawing for*

---

The authors are solely responsible for the content of this technical presentation. The technical presentation does not necessarily reflect the official position of the Council of Educators in Landscape Architecture (CELA), and its printing and distribution does not constitute an endorsement of views which may be expressed. Technical presentations are not subject to the formal peer review process by CELA Track Chair System; therefore, they are not to be presented as peer-reviewed publications. Citation of this work should state that it is from a CELA conference paper. EXAMPLE: Author's Last Name, Initials. 2014. Title of Presentation. CELA Paper No. 14-xxxx. Baltimore, Maryland: CELA. For information about securing permission to reprint or reproduce a technical presentation, please contact CELA at [dsolco@uta.edu](mailto:dsolco@uta.edu) or 817-272-2321.

*Landscape Architecture*” by Brad Cantrell and Wes Michaels replaced “*Drawing the Landscape*” by Chip Sullivan as the visual and representation text for landscape architects. A great deal can be argued on the digital-analog topic, but what is relevant to this discussion is the value of educational content and formats that integrate sketching in the analysis and design of landscapes.

Sketching and its relevance to academic practice and pedagogy was revisited in Caroline Laviorie’s “*Sketching the Landscape: Exploring a Sense of Place*”. (Laviorie, 2005) followed by “*Exploratory Physiocartographies of Place and Time*” A sketch crawl and panel discussion at the 2013 Annual CELA meeting in Austin (CELA 2013). Between 2005 and 2013 there were a series of lectures and activities that formally discussed the practice and theory of sketching; ranging from the history and theory of drawing and architecture in “Is Drawing Dead?” Symposium at the Yale School of Architecture (Yale, 2012) to the Urban Sketchers first International Symposium in Portland, Oregon (Urban Sketchers, 2009), to the publication of *Freehand Drawing and Discovery: Urban Sketching and Concept Drawing for Designers* (Richards, 2013). Since the 2013 CELA meeting, the American Society of Landscape Architects (ASLA) has organized three sketch events (Sketch Walks) for their annual meetings and the Sketch Out/Loud public awareness event for the celebration of World Wide Landscape Architecture. Several Landscape Architecture programs have reintegrated sketching and sketch walks as part of design studio.

## **2 SKETCH WALKS**

The discussions, publications and activities on sketching have a common theme: The importance of the direct exploration and discovery of place through sketching. The Sketch Walk (Sketch Walk will be used to describe the process of walking through an area and drawing what you see or calls your attention), provides a structure to organize sketching activities that can address the specific objectives of a design studio or public participation program. The format for Sketch Walks

can vary from structured and directed to free and rambling; from day long events to gatherings of short duration. The walking can be on a planned course or a self-directed route. This flexibility allows participation at all levels of skill and purpose.

For the pedagogy of landscape architecture, specifically, sketching place with Sketch Walks requires the formalization of a process that frames the walk within a specific need or desired outcome. The basic questions to answer, based on the experience of planning ASLA and Urban Sketcher Sketch Walks, are: “What aspects of place or design are to be stressed?” and “How will they be recorded or documented?” These broad questions allow for the exploration of design concepts through the practice of on-site discovery, and analysis. The method of recording and documenting of the walk strengthens the practice of drawing and mapping operations.

### **3. SKETCH WALK: METHODS AND OPERATIONS**

Sketch Walks have been offered as field sessions at the last three ASLA conferences. Sketch Boston, Denver and Chicago (ASLA 2013, 2014, 2015) were guided walks that used sketching to document the unique urban character of the three cities. The walks were organized by a group of landscape architecture practitioners and educators who used sketching as an integral part of practice and studio education. The walks were structured to include the presentation of historic context, sketching demonstrations, sketching exercises with one-on-one guidance and group discussions on sketching, place and representation. A description of the organization and planning of the sketch walks follow, as a way to discuss methods and techniques.

#### **3.1 Organization**

The first step in planning and organizing the Sketch Walk was to prepare an outline and discuss the physical, social and historic aspects that defined the city. The discussion included a

review of existing and proposed architecture and open space, significant landmarks, food, people, historic events and personal experiences. Subsequently these spaces were located on a map and we coordinated the logistics of moving from one place to the other considering the amount of time for the session. It is also important to state that these Sketch Walks were not perceived as jumping from one point to the other, but rather moving from space to space. This is a significant consideration or approach to the walks since the process mimics how landscape architects conceive and design space, as the articulation of physical spatial movement and aligns with the sequential spatial experience and documentation methods described by Cullen (Cullen 1961) and Gehl and Svarre (Gehl and Svarre, 2013). At the end of these discussions we had a series of notes, conceptual diagrams and maps that outlined several ways of approaching the walk. (Figure 1.)



Figure 1. Final and Draft Map from the 2104 ASLA Field Session: Sketch Denver. By Author.

### 3.2 Exploration

A field visit to the city connected the ideas and concepts about the walk with the physical reality of the space. The exploration phase of the development of the walk was phenomenological; as it considered discoveries that arose from walking the city, and cartographic (Cartesian) in its fixing of structures, streets and spaces on a map. The reconnaissance walk changed some perceptions about the spaces and allowed for the inclusion of structures, spaces and views not remembered from previous visits, not apparent on maps and not seen on Google Street Views. These adjustments generated a map, path and a set of exercises that illustrated salient spatial, physical and historic components (Figure 2).

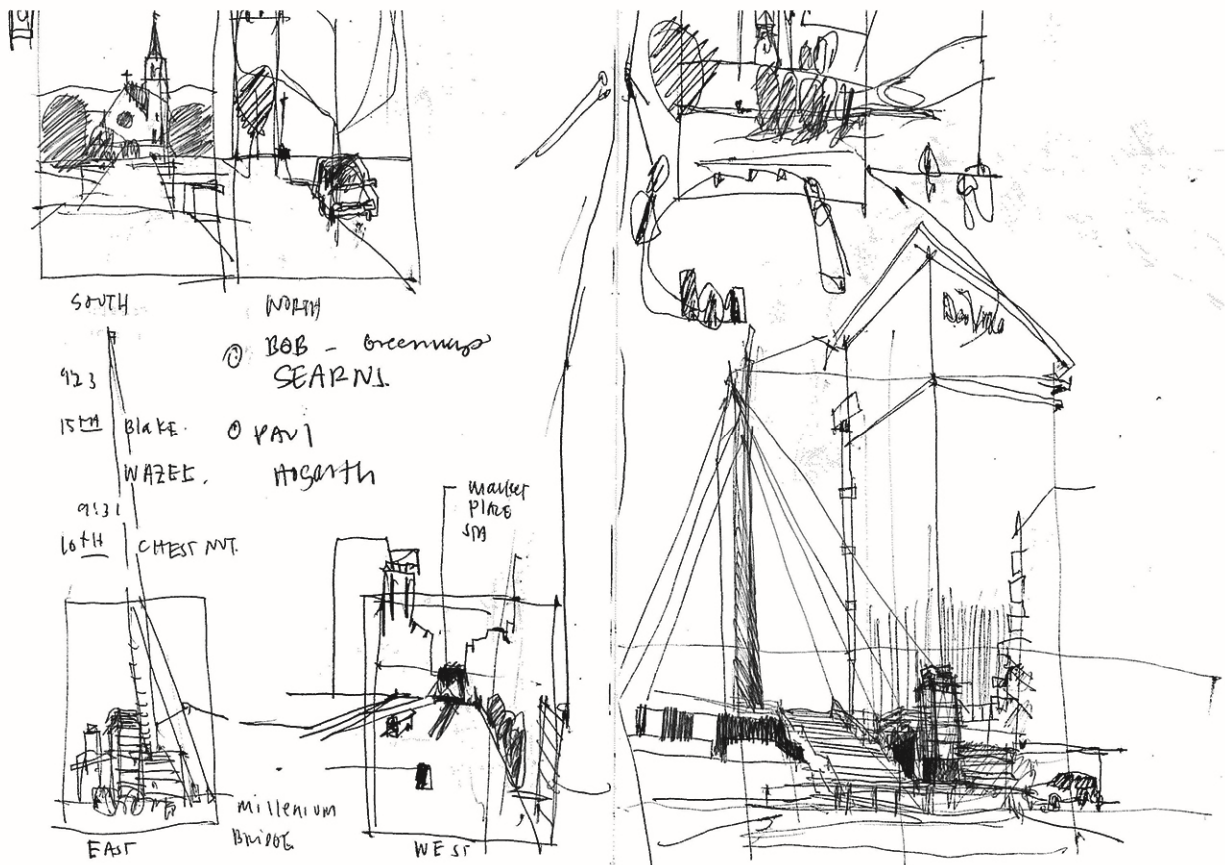


Figure 2. On-site walk preparation sketches for the 2104 ASLA Field Session: Sketch Denver. By Author.

### 3.3 Discovery



The walks had two groups; the organizers and the participants. The organizers had, through a process of exploration and synthesis, directed the movement through a location and determined the salient aspects of the site. These aspects were explained and demonstrated through sketching and the walk itself. The participants followed the prescribed movements and exercises, first to grasp the organizer's points, then to build their own experience. In the process there were discussions between the organizer (guide) and participant (discoverer); a conversation that developed and expanded the visual, physical and historic understanding of the site and created an experience of place (Figure 3).



Figure 3. Sketch from the 2103 ASLA Field Session: Sketch Boston. By Author.

#### 4 THE SKETCH WALK AS AN OUTDOOR DESIGN STUDIO

On the surface sketch walks, and the many other on-location sketching activities available to the general public (Urban Sketchers, Sketch Meet Ups, Dr. Sketchy) seem like fun activities for

sketching enthusiasts. In recent years many landscape architecture practitioners, instructors and students have participated in sketch walks and have discovered that, they are useful to hone sketching and drawing skills, have precedents in artistic and social movements, and can be used, along with the sketchbook, as an on-site analysis tool for design. The scholarly aspects of these points have been argued, in positive terms (Lavorie, 2005 and CELA 2013) and have been fixed within a historic, artistic and social framework. The sketch and the sketchbook for example, were used as a way to develop and compose a painting, as a sort of rehearsal to the final work (Petherbridge, 2010) and that sequential process, from idea to final work, is essentially the design process. The need to capture the “real world” in illustrative sketches of new found lands and its people, in explorer logs, artistic travelogues and cartographic representations used travel, discovery and sketching documentation as the way to show and relate the world to others. So the argument that walking and sketching can capture, depict and show place is clear. The use of sketches, text and maps as qualitative methods to document perception of place by designers and non-designers is tied to the planning oriented cognitive maps in *Image of the City* (Lynch, 1961) and mapping operations on the one hand and the socially subversive movements that questioned power, creating alternate ways to experience and depict the city, like the Situationist (Debord, 1995), and Psychogeographic movements on the other (Coverly, 2010).

The Sketch Walk combines sketching and walking; the embodied and the cognitive, in a format that is flexible and simple to construct. Location (place to be studied), Movement (the ways to move through the space) and Record (the ways of sketching the experience) constitute the components of the walk that can be directed to focus on a specific aspect of design or analysis. Defining the purpose of the three components, the organizer (instructor, landscape architect, community designer, or place maker) can structure an activity that produces information



(quantitative or qualitative) that be part of design development or team building. In addition the organization of the activity as a Sketch Walk provides a “big tent” that can hold a variety of artistic, social and design intentions.

The hand drawn final rendering in landscape architecture has evolved into refined computer generated two and three dimensional images and models. The sketch as a fixed exercise with in a linear trajectory towards the production of a final piece, be it a design or in the case of the artist, an art piece, is used less and less. Still, sketching and drawing remain an importance practice. Observation, familiarity with drawing media, the development of speed and visual communication are embodied skills that initiate and mimic the design process. Walking through a space, using all senses to orient, perceive and remember is the process used to cognitively determine or fix place in our minds.

Academic programs, regardless of their focus or tradition, grapple with a broad charge; the formation and development of a professional Steward of the Land. Stewardship of the land is a global endeavor that has no borders physically or intellectually, which is to say that the very nature of landscape architecture; encompassing, a bit vague, phenomenological and cartographic, artistic and scientific, executes its work in a multidisciplinary or transdisciplinary framework, wrought with dilemmas, conflicts, debates and contradictions. It is the principal argument of this paper that the Sketch Walk, in its organization and execution, is an activity that mimics the skills required to experience and document space and initiate the process of analysis and conceptualization; that the Sketch Walk can engage instructor, student and practitioner in an operation, that contributes to the design of urban spaces.

## 5 REFERENCES

- ASLA (2013). Annual Meeting and Expo of the American Society of Landscape Architects, Boston, Massachusetts. “Sketch Boston”. Retrieved on December 30, 2105 from: [https://www.asla.org/uploadedFiles/CMS/Meetings\\_and\\_Events/2013\\_Annual\\_Meeting\\_Handouts/FS017%20Sketch%20Boston.pdf](https://www.asla.org/uploadedFiles/CMS/Meetings_and_Events/2013_Annual_Meeting_Handouts/FS017%20Sketch%20Boston.pdf) .
- ASLA (2014). Annual Meeting and Expo of the American Society of Landscape Architects, Denver, Colorado. “Sketch Denver”. Retrieved on December 30, 2105 from: [https://asla.org/uploadedFiles/CMS/Meetings\\_and\\_Events/2014\\_Annual\\_Meeting\\_Handouts/FS-012\\_SKETCH%20DENVER.pdf](https://asla.org/uploadedFiles/CMS/Meetings_and_Events/2014_Annual_Meeting_Handouts/FS-012_SKETCH%20DENVER.pdf).
- ASLA (2015). Annual Meeting and Expo of the American Society of Landscape Architects, Chicago, Illinois. “Sketch Chicago”. Retrieved on December 30, 2105 from: [https://asla.org/uploadedFiles/CMS/Meetings\\_and\\_Events/2015\\_Annual\\_Meeting\\_Handouts/FS-011\\_SKETCH%20CHICAGO.pdf](https://asla.org/uploadedFiles/CMS/Meetings_and_Events/2015_Annual_Meeting_Handouts/FS-011_SKETCH%20CHICAGO.pdf).
- Campanario, G. (2012). *The art of urban sketching: Drawing on location around the world*. Quarry Books, Beverly, MA.
- CELA (2013). 2013 Annual Meeting of the Council of Educators in Landscape Architecture University of Texas Austin “Exploratory Physiocartographies of Place and Time”, retrieved on December 30, 2015 from: <https://cela2013sketchcrawl.wordpress.com/>
- Coverly, M. (2010). *Psychogeography*. Pocket Essentials, Harpenden , England.
- Cullen, G. (1961). *The concise townscape*. Routledge Architectural Press, New York, NY.
- Debord, G. (1958). *The society of the spectacle*. Zone Books, New York (1995)
- Gehl ,J.and Svarre,, B. ( 2013). *How to study public life*. Island Press, Washington, D.C.

- Gilbert, B. (From 2005-2007). Physiocartographies Blog. Retrieved on December 30, 2015 from: <http://www.unm.edu/~wgilbert/physio.html>, retrieved on December 30,2015
- Lavoie, C. (2005). Sketching the Landscape: Exploring a Sense of Place. *Landscape Journal* 24:1 13-31. University of Wisconsin System.
- Lynch, K. (1960). *The image of the city*. MIT press, Boston , MA
- Richards, J. (2013). *Freehand Drawing and Discovery: Urban Sketching and Concept Drawing for Designers*. John Wiley & Sons. Hoboken, NJ.
- Petherbridge, D. (2010). The persistent cult of the sketch. In, *The Primacy of Drawing: histories and theories of practice*. (pp. 26-46). Yale University Press, New Haven, CT.
- Self, W., & Steadman, R. (2007). *Psychogeography: Disentangling the modern conundrum of psyche and place*. Bloomsbury Publishing USA.
- Urban Sketchers (2009) . 1<sup>st</sup> International Urban Sketching Symposium. Retrieved on December 30, 2015 from: <http://pdx2010.urbansketchers.org/>
- Yale (2012). Yale School of Architecture asks: “Is Drawing Dead?”, retrieved on December 30, 2015 from: <http://news.yale.edu/2012/02/03/yale-school-architecture-symposium-asks-drawing-dead>

## BIO

Richard Alomar is an Assistant Professor of Landscape Architecture, Extension Specialist and Co-founder of New York Urban Sketchers. He has an undergraduate degree in Agronomy from the University of Puerto Rico at Mayaguez and an MLA from Louisiana State University. Richard’s general research focus is on land stewardship in urban underserved communities with a specific emphasis on the visual analysis and documentation of urban landscapes through participatory process. He has developed two community outreach programs that use sketching to document and record place (Sketch Out/Loud) and track gardener’s attitudes towards work, health and each other (Healthy Gardens for Healthy Cities).



COUNCIL OF EDUCATORS  
IN LANDSCAPE ARCHITECTURE

*A CELA Conference Presentation*

*Abstract ID: 230*

## CONTEXTUALIZING DATA WITH LANDSCAPE REPRESENTATION TOOLS: ADDING MEASURE AND PERSPECTIVE FOR PUBLIC EVALUATION

**SCHRAMM, SARAH**

Research Specialist, Louisiana State University Coastal Sustainability Studio

**MITCHELL, JACOB**

Assistant Professor, Louisiana State University Coastal Sustainability Studio

**CARNEY, JEFF**

Associate Professor, Louisiana State University Coastal Sustainability Studio

### 1 ABSTRACT

*The In working across disciplines with the shared goal of educating the public, it becomes evident that different disciplines rely on different tools for visual communication. At the trans-disciplinary Louisiana State University Coastal Sustainability Studio (CSS), we work with scientists, engineers, and designers to envision and design sustainable systems on Louisiana's coast. In our work we find that data-rich graphs and charts used by scientists and engineers often fall short of communicating the significance of a relationship or process to the public. Visually communicating this meaning is an interpretive step that is necessary for meaningful public engagement.*

*In Louisiana, the coastal land loss crisis impacts communities, industry, and ecological systems at a massive scale and rapid rate. To address this, the State of Louisiana's Coastal Protection and Restoration Authority (CPRA) developed the Comprehensive Master Plan for a Sustainable Coast, which proposes a range of projects to restore large-scale systems across the coast. The investment and coordination needed to accomplish the goals of the Master Plan require broad public support and funding. To achieve this, CPRA must find a way to present complex concepts to the public in a way that is meaningful, convincing, and moving, in order to inspire the will to act among the public and political leaders.*

*The CSS has been commissioned by the CPRA and other NGOs in Louisiana to develop visual material to convey the complex processes underpinning coastal protection and restoration. Drawing inspiration from work such as Hill's writings on climate change and the sublime, Misrach and Orff's Petrochemical America, and a host of designers and coastal science educators at Louisiana State University, the CSS is developing a visualization approach that bridges the specificity of data analytics and science communication with an aesthetic tradition germane to landscape architecture.*

*The drawings the CSS produces strive to convey ecological and geomorphological processes, as well as show how these relate to human perspectives and use of the landscape. This approach builds on the framework of ecological understanding developed in Hill et al. (2002). The melding of science with abstraction enables viewers to experience the ephemerality and potential unknowns existing in*

---

The authors are solely responsible for the content of this technical presentation. The technical presentation does not necessarily reflect the official position of the Council of Educators in Landscape Architecture (CELA), and its printing and distribution does not constitute an endorsement of views which may be expressed. Technical presentations are not subject to the formal peer review process by CELA Track Chair System; therefore, they are not to be presented as peer-reviewed publications. Citation of this work should state that it is from a CELA conference paper. EXAMPLE: Author's Last Name, Initials. 2014. Title of Presentation. CELA Paper No. 14-xxxx. Baltimore, Maryland: CELA. For information about securing permission to reprint or reproduce a technical presentation, please contact CELA at [dsolco@uta.edu](mailto:dsolco@uta.edu) or 817-272-2321.

*environments while providing defensible position for argument and consensus building around specific programmatic objectives.*

*By integrating the human perspective, we believe the public will be better equipped to evaluate the risks and opportunities of their landscape and understand the benefits offered by the Master Plan proposal.*

### **1.1 Keywords**

Visual communication, ecological understanding, public understanding, Coastal Sustainability Studio (CSS)

## **2 INTRODUCTION**

In working across disciplines with the shared goal of educating the public, it becomes evident that different disciplines rely on different tools for visual communication. At the trans-disciplinary Louisiana State University Coastal Sustainability Studio (CSS), we work with scientists, engineers, and designers to envision, design, and communicate sustainable communities, environments, and coupled systems on Louisiana's coast. In our work we find that for those trained in abstract thinking such as designers and scientists and familiar with the mechanisms of a particular process, graphs and charts are often sufficient to convey meaning. When communicating with the general public, however, we believe these communication tools often fall short, at most communicating *that* something happens, without explaining how and why it happens, nor its broader significance. If the goal is to meaningfully engage the public in civic discourse and participation, then we propose for visualizations to go beyond traditional science communication techniques to generate a greater sense of what the data mean for different user groups.

In Louisiana, informed engagement in civic discourse regarding coastal land loss is critical and urgent. Since 1932, coastal Louisiana has lost 1,883 square miles, one quarter of the 1932 land area (Couvillon et.al., 2011). This is approximately 300 more square miles than the entire state of

Rhode Island. For the past 30 years the rate of land loss has averaged just over 16 square miles per year, which, if distributed evenly, would be equivalent to the area of a football field of coastal land lost every hour. This land loss has impacts that range from local to global, effecting communities, habitats, fisheries, oil and gas, shipping, and carbon sequestration.

In order to address this rapid and far-reaching problem, the citizens of Louisiana and the larger United States need to be informed and understand the urgency of the situation in order to take action in a timely manner. Several organizations have been and continue producing material to educate the public, including non-profit and governmental organizations; however, misinformation, counter-narratives, and conflicting interests hinder consensus-building at the scale needed for large-scale action.

One organization, the State of Louisiana's Coastal Protection and Restoration Authority (CPRA), a group that integrates the expertise and resources of the Department of Natural Resources, the Department of Transportation and Development, and other state agencies, is charged with developing a Master Plan for Louisiana's coast. This Master Plan, which is revised every five years, proposes a range of projects to restore large-scale systems across the coast (Coastal Protection & Restoration Authority, 2012). The investment and coordination needed to accomplish the goals of the Master Plan require broad public support and funding. To achieve this, CPRA must find a way to present complex concepts to the public in a way that is meaningful, convincing, and moving, in order to inspire the will to act among the public and political leaders.

The CSS has been commissioned by the CPRA as well as by local and national NGO's including the National Wildlife Federation (NWF) and the Coalition to Restore Coastal Louisiana (CRCL)

to develop visual material to convey the complex processes underpinning the need for coastal protection and restoration and the specific projects being proposed. Our goal is to inform and engage the public, preparing them to make informed decisions and bolster political will to take collective action regarding coastal land building strategies. Drawing inspiration from writings on climate change and the work of landscape designers, the CSS is developing a visualization approach that bridges the specificity of data analytics and science communication with an aesthetic tradition germane to landscape architecture.

Writing on climate change, Kristina Hill's work discussing what landscape architects can do to engage themselves and the larger public in responding to climate change has helped us clarify our strategy of using aesthetics to enhance ecological understanding. In her lecture at Coastal Sustainability Studio, Hill discusses the role of aesthetic performance to inspire in the public the courage to invest, a sense of shared resourcefulness, and the expansion of public compassion (2013). She gave examples of public infrastructure projects that engaged with aesthetic performance as an additional layer to an engineering solution in order to achieve these goals. By designing with beauty and narrative, a designer engages an observer's imagination.

While the work presented in this paper does not showcase "project design" of physical infrastructure projects *per se*, we, as landscape architects do rely on the principles of design to drive our communication and education work. We do this by showing more than the basics of a flow diagram—we engage with beauty, narrative, and different orientations, to engage the imagination of the viewer. In this way, we intend for our work to promote the public's existing ecological understanding of Louisiana's coastal crisis—helping them understand the web of interrelated relationships that tie changes in ecological and geological processes to impacts in

human communities, economies, and ways of life (Hill et. al., 2002). By empathizing with the human in the landscape in these drawings, we engage the viewer's imagination foster an understanding for the need for state led restoration that leads to project support and informed decision making.

Previous examples by designers integrating data with the experience of a place include Mathur and de Cunha's Mississippi Floods (2001), Misrach and Orff's Petrochemical America (2014), and Seibert's Dredge Research Collaborative work with the CSS (Milligan, 2015). These precedents tested methods of layering data and collaging human experience. All three resources contain beautiful, data rich images that are best studied in print and book form. In contrast, the work presented in this paper is primarily intended to be delivered in a presentation, on a screen, or in a mass-produced hand out. The drawings must work quickly in this forum to communicate broadly about not only the need for restoration but the stake that most Louisiana citizens have in it.

### **3 METHOD**

In our drawings we try to convey ecological and geomorphological processes and show how these relate to human perspectives and use of the landscape. We do this by contextualizing the data in a place or scene. In the scenes we both show a *landscape aesthetic* and use techniques developed in the tradition of landscape architecture visualization. Here, we use the term *landscape aesthetic* to refer to a set of principles underlying and guiding the work of landscape processes. This builds on an existing definition of *aesthetic*, "a set of principles underlying the work of a particular artist or artistic movement" (Oxford University Press, 2016). An example of showing a landscape aesthetic would be drawing a sediment plume at the mouth of a river to



indicate that the river is carrying sediment out into a larger body of water. In this case, the landscape process would be sediment deposition and the principles underlying it would be that the river carries it to an open body of water. While the river could be accurately drawn without the sediment plume, the plume's addition conveys a landscape aesthetic, or underlying process.

We also engage with the Greek roots of the term *aesthetic*, using visual cues to convey multisensory perception and experiences that are felt, as opposed to what is known intellectually. This use relates to visualization techniques developed in landscape architecture: representations of ephemerality and ambience. Ephemerality is an experience of space that is important to represent because the landscape architect will have considered how a place changes through the seasons, through the years, and through the various perspectives of a person moving through the space. These considerations of change over time are often represented with semi-transparent elements. Trees, for example, are often shown as semi-transparent because they are only temporary visual barriers, both temporally (through the seasons and years as they change shape) and spatially (along the course of a person's path). Seeing trees represented semi-transparently in a static image relates to a person's experience of change and movement through a landscape.

Representations of ambience are yet another technique used by landscape architects. Ambience can be represented in many ways to convey many qualities about a space. Wind can be shown with white caps or blowing hair; muggy air can be shown with haze and the quality of light. Details such as these can trigger a sense of what the air of a place might feel or even smell like. By using the representation tools of landscape aesthetics, ephemerality, symbology, and ambience to augment data, we at the CSS have created visuals that try to communicate processes,

an experience of place, and relationships in data that will make the information about coastal land loss meaningful to the public.

## **4      EXAMPLES**

### **4.1    The Growth of Louisiana's Delta**

Our first example of a drawing that integrates data and human perspectives is a series called *The Growth of Louisiana's Delta* (Figure 1). In these images we show current geological theory of where the Mississippi River deposited sediment over 6500 years. The intention is to highlight the relationship that when the river would change course, new land would build along the new route, while along the old route no longer supported by river inputs, land would erode. This message highlights the dynamic and impermanent nature of deltaic land, which is an important foundation for understanding why Louisiana is experiencing a land-loss crisis today.

The data conveyed in *The Growth of Louisiana's Delta* are the river courses and lobe names, extents, time frames, and area built. The information about river courses was simplified from a 1944 geological investigation of the Mississippi River stream courses (Office of the President, 1944). This information accompanied a 170-page document that has formed the foundation of how geologists understand the age and development of the delta through a sequence of lobes (Fisk, 1944). Subsequent work simplified the lobe sequence into between 5-7 major divisions (Frazier, 1967, Morgan, 1977). Land area was based on McLindon's presentation of Frazier's work (McLindon, 2015). In our drawing, we simplified the graph and removed numbers on the y-axis to focus the viewer's attention on trends and relationships.

Using these resources, we made the information more meaningful to viewers by introducing landscape aesthetics. To do this, we added details that suggest materials and processes that help reinforce the underlying coastal principles at work. Colors and patterns that suggest material quality of land, water, and sediment, are a simple addition to a geology drawing that helps reclaim the specificity of the subject. The viewer can see the materials that are moving over time rather than abstract lines. To convey the underlying processes, we used sediment plumes to show an active river depositing sediment. We also showed lobes in decay with a tattered look to the land. These details help give the drawing signs of life and change, reinforcing the message objective of a dynamic coast.

By integrating data with landscape aesthetics in *The Growth of Louisiana's Delta*, we strive to reconnect the experience of a landscape—the tactile materials and flows—with the abstract representations of the geologic history of the site. This strategy engages both the logics of scientific knowledge and the logics of perception. In doing so, the explanation of how the landscape evolved over time carries a more nuanced message than the geology drawings while simultaneously being more readily understood by viewers. By understanding the history and processes that led to the development of Louisiana's delta, the public will be better equipped to build on that knowledge to understand how river management practices have affected the land building and land decay processes inherent to the system.

## **4.2 Shrimp Eye View**

Our second drawing, *Shrimp Eye View*, shows the life cycle of a shrimp from the perspective of a shrimp travelling from a low salinity environment full of food, shelter, and predators as it returns to the gulf to spawn (Figure 2). The intention is to contextualize life cycle information while

also relating the ideas of shrimp as an environmental variable with shrimp as a resource. By relating these two ideas, we embed information that shows connection between freshwater marsh habitat and an economic resource while showing the basic elements of the shrimp life cycle.

In this drawing, the data conveyed are the life cycle of shrimp as they move through waters of different salinities and dangers, and habitat elements like food, predators, and shelter. The information about life cycle and habitat is from Louisiana Sea Grant and U.S. Fish and Wildlife service (Louisiana Sea Grant, n.d., Muncy, 1984). Currently, a common visual guide for showing how shrimp move through an estuary during its life cycle is a Louisiana State University Sea Grant poster, shows images of shrimp life stages superimposed on a simple plan-view map, like the one shown (Louisiana Sea Grant, n.d.).

Taking these resources, we added additional elements that take the abstract information of where shrimp are during different life stages and make it more visceral and meaningful to human systems. These additional elements are a habitat scene and a perspective view. In *Shrimp Eye View*, the habitat scene presented in section shows predators, shelter, and food with realistic qualities of texture and scale. The scene contextualizes the shrimp's environment, imbuing the image with signs of life, ambience, and relationships between elements. The activity and relationships are intended to capture the viewer's imagination and set the scene for a story.

Drawing in perspective was a second tool we used to incorporate aesthetics and engage the viewer. The use of perspective helped us create a narrative of a journey, highlighting the distance and dangers with the foreshadowing of a dramatic scene at the end. Additionally, taking the point-of-view away from a human's experience and applying it to the shrimp helps the viewer develop an intimate awareness of the needs and challenges of other living things in the system.

This awareness of other perspectives within the shared system is intended to increase the ecological understanding of viewers, enhancing their ability to make informed decisions about how coastal management decisions have a chain of effects.

By applying aesthetic qualities to ecological information, this visualization explores the intersection of ecological and human systems. It juxtaposes two perspectives of Louisiana shrimp: the ecosystem where white shrimp develop into adulthood and their harvest by fishermen for consumption and sale. This drawing helps to bridge conversations in coastal Louisiana between those advocating for the environment and fishing industry; both have a common interest in the shrimp, but view the species from different perspectives. By seeing the shrimp both as a creature that requires particular habitat conditions to grow and as a resource for human use, we can help expand the conversations of how aquatic resources are managed to better achieve sustainability goals.

#### **4.3 Coastwide Reference Monitoring System Stations in Barataria Basin**

The third drawing, *Coastwide Reference Monitoring System Stations in Barataria Basin*, uses a landscape scene to explain how Louisiana's Coastwide Reference Monitoring System Stations are used to collect a wide range of measurements about how the coast is changing (Figure 3). This drawing is intended to inform the public about data collection methods used by the CPRA to monitor long-term changes in soil, water, and vegetation across the Louisiana coast. The image provides context for the public to interpret the CPRA's data and also demonstrates the rigor the CPRA employs in monitoring and responding to issues facing the coast.

The science conveyed in this drawing are the tools used to assess how the coast is changing, what the tools monitor, which data are collected, and what the data are used for. Existing resources for this information are the CRMS Fact Sheet (Steyer, 2010) and the CRMS website which provides data access (*Coastwide Reference Monitoring System*, n.d.). Visual explanations of how these tools work together to tell the story of coastal changes are limited to photos of individual data collection sites and maps showing how the stations are arranged.

Using these resources, we added aesthetic qualities that give the information meaning by compressing space, by adding signs of life, and using a section to add context. In our drawing we show all of the station elements together in one scene, as if they are side-by-side. In reality, they are hundreds of feet apart. This compression of space allows us to better tell a narrative featuring the elements of coastal monitoring, highlighting the places where monitoring action occurs. We further amplify this narrative quality by showing people using the monitoring tools, giving the drawing signs of life and demonstrating that these tools are valuable to people. Adding context for the tools in section allowed us to show the relationships between each tool and what it monitors in the environment. By showing what is otherwise unseen we are able to improve the viewer's understanding of elements in the environment that are changing and how the CPRA's tools monitor that change. This understanding is intended to add meaning to the data that come from the monitoring tools.

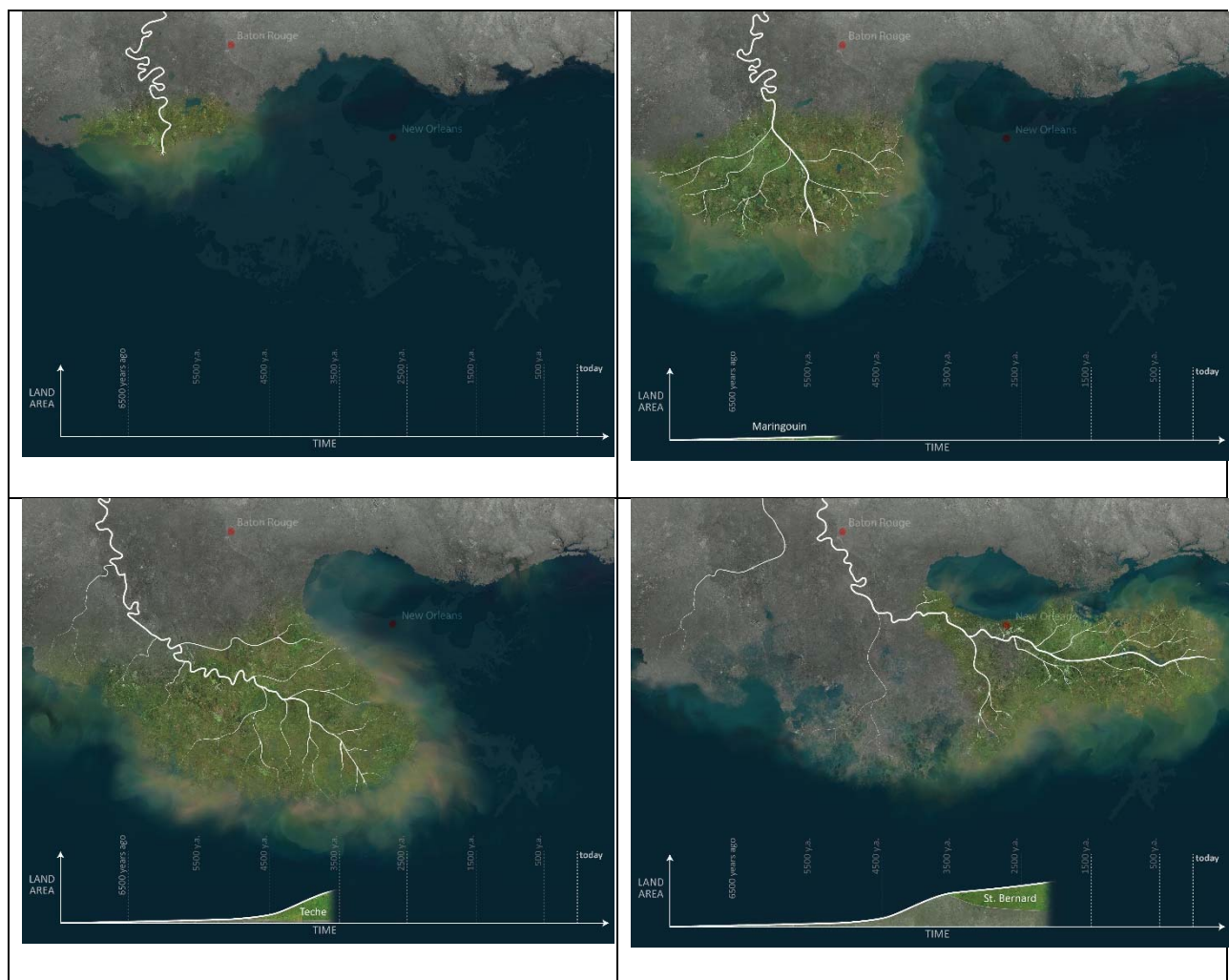
## **5 CONCLUSION**

What we have demonstrated in *The Growth of Louisiana's Delta*, *Shrimp Eye View*, and *Coastwide Reference Monitoring System Stations in Barataria Basin* are strategies for integrating visualizations of aesthetic experience with ecological and geological data in order to

contextualize the information and add meaning for the viewer. By doing this, our aim is to improve the public’s ecological understanding in order for them to understand the land loss crisis coastal Louisiana is experiencing. Visually communicating this meaning is an interpretive step that we think is necessary for meaningful public engagement.

In *Shifting Sites*, Kristina Hill writes, “sites are where the sciences and humanities meet” (Hill, 2005). This is what we are trying to show—how these systems are intertwined in coastal Louisiana in a way that relates to people’s experience and inspires them to act.

## FIGURES



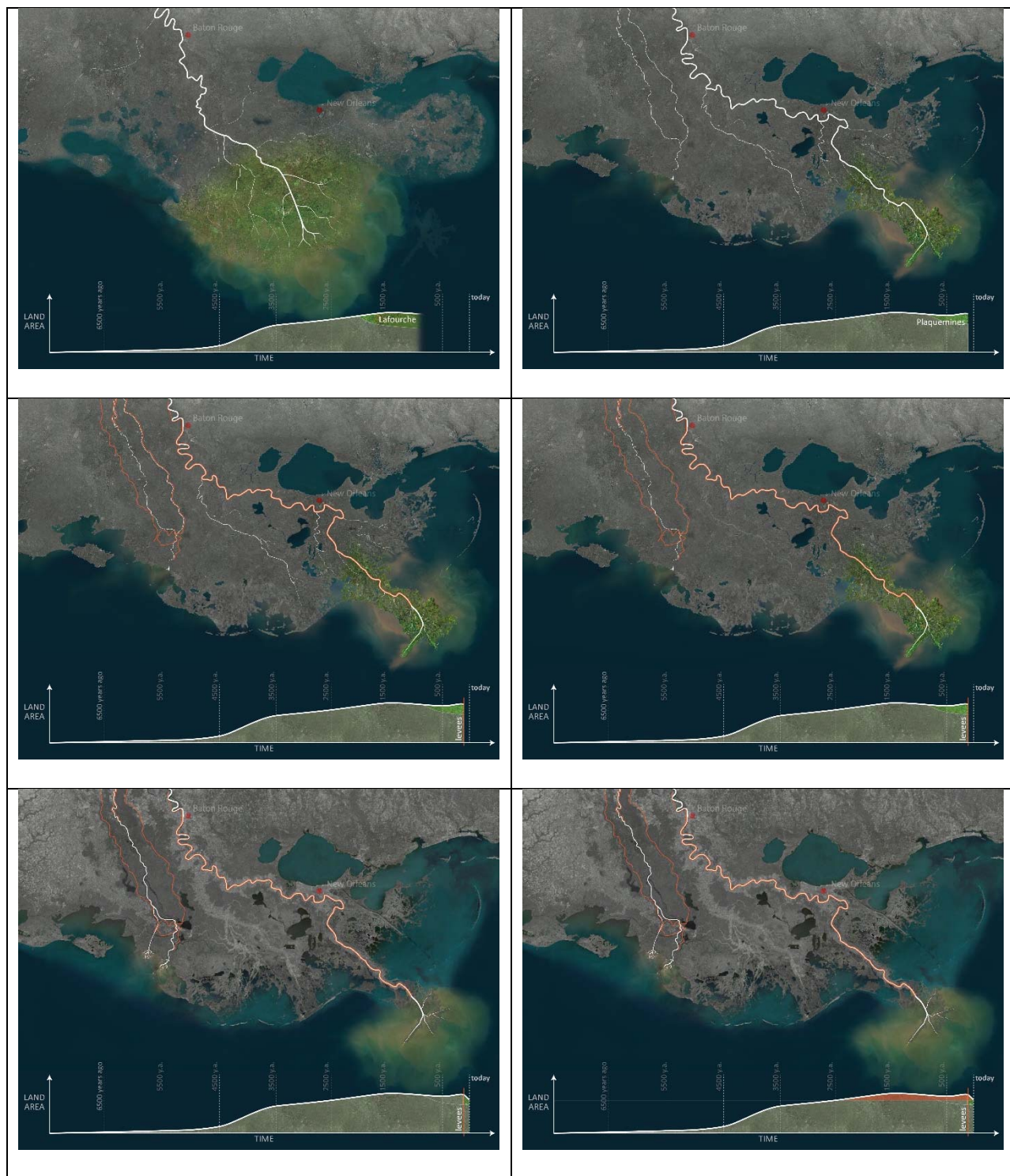






Figure 1. *The Building of the Louisiana Delta.*

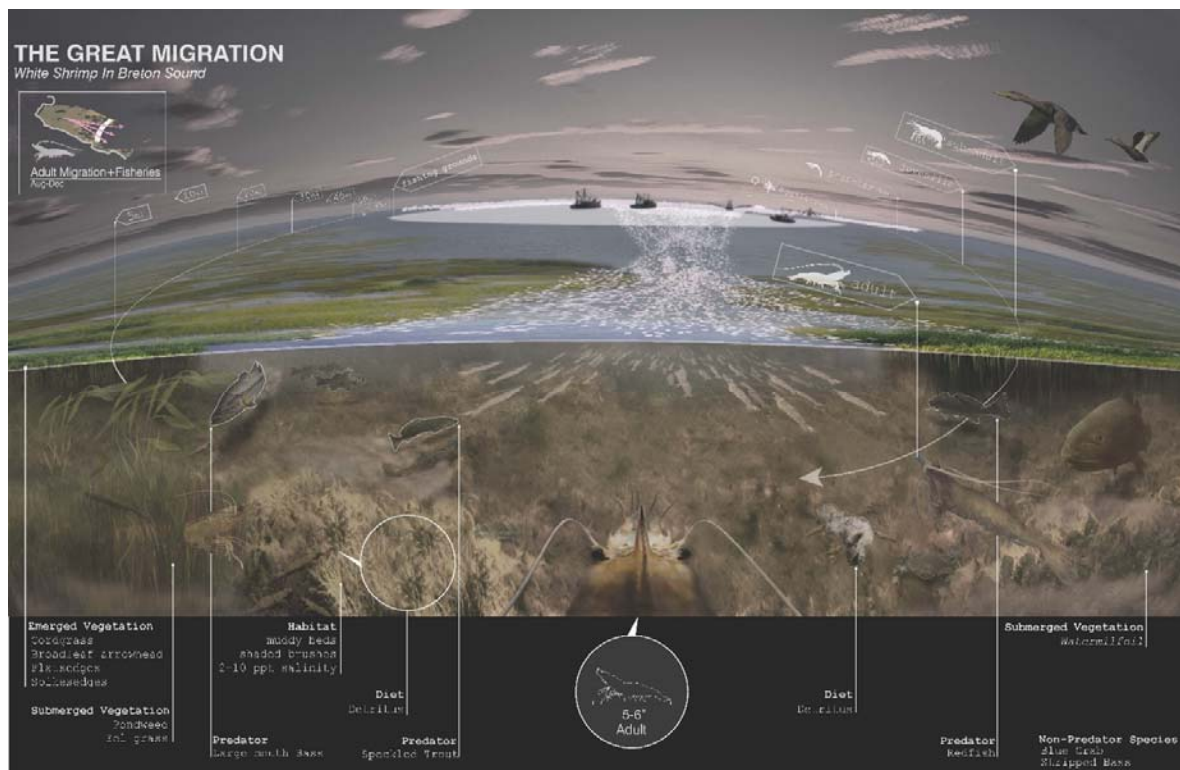


Figure 2. *Shrimp Eye View.*

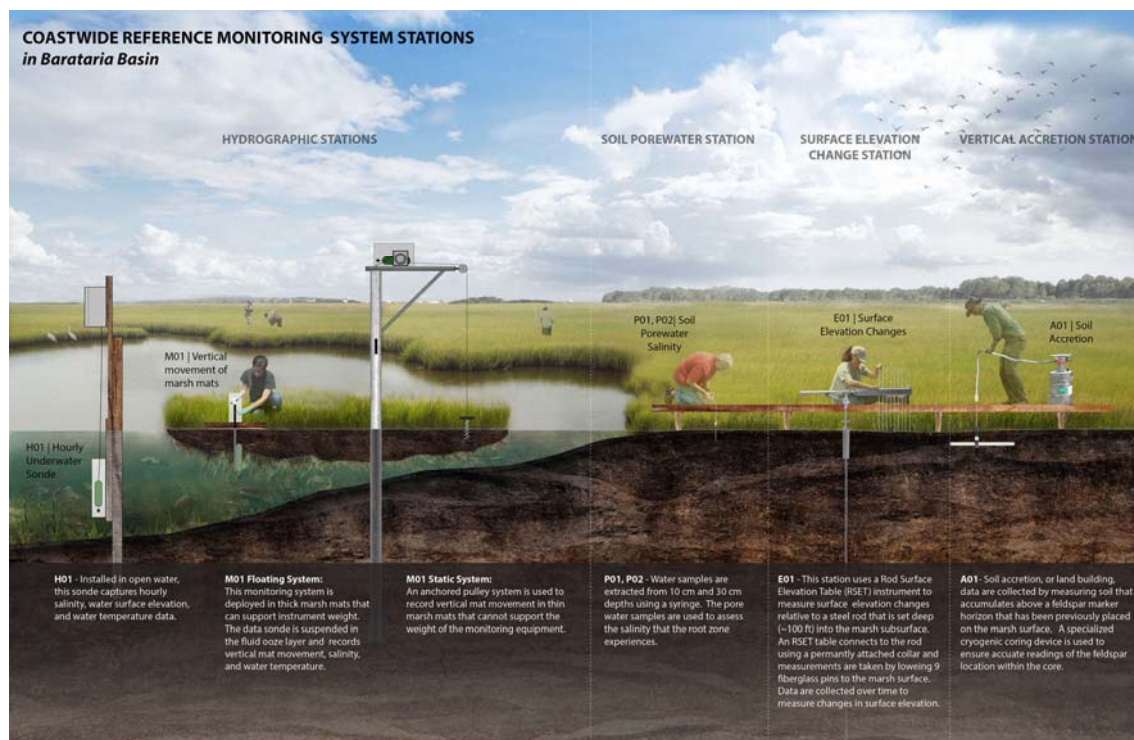


Figure 3. *Coastwide Reference Monitoring System Stations in Barataria Basin.*

## 5 REFERENCES

Coastal Protection & Restoration Authority. (2012). *Louisiana's comprehensive master plan for a sustainable coast*. Baton Rouge, LA: Coastal Protection & Restoration Authority.

*Coastwide Reference Monitoring System*. (n.d.). Retrieved from <http://lacoast.gov/crms2/home.aspx>.

Couvillion, B.R., Barras, J.A., Steyer, G.D., Sleavin, W., Fischer, M., Beck, H., ... Heckman, D. (2011) *Land area change in coastal Louisiana from 1932 to 2010: U.S. Geological Survey Scientific Investigations Map 3164*, scale 1:265,000, 12 p. pamphlet.

Fisk, H.N. (1944). Geological investigation of the alluvial valley of the lower Mississippi River, Report to the Mississippi River Commission.

Frazier, D.E. (1967). Recent deltaic deposits of the Mississippi River: their development and chronology. *Gulf Coast Association of Geological Societies Transactions*, 27, 287-315.

Hill, K. 2005. Shifting sites. In C.Burns & A. Khan (Eds.), *Site matters: Design concepts, histories, and strategies* (131-156). New York, London: Routledge.

Hill, K. (May 10, 2013). *Shorelines spectacle: Aesthetic experience and infrastructure*. Presented at Louisiana State University, School of Art and Design, Coastal Sustainability Studio. Retrieved from

<http://coadmediasite.lsu.edu/mediasite/SilverlightPlayer/Default.aspx?peid=1ba7d51c4da64361ba3dec432c10b9ad1d>

Hill, K., White, D., Maupin, M., Ryder, B., Karr, J. R., Freemark, K....Schauman, S. (2002). In Expectation of relationships: Centering theories around ecological understanding. In B.R. Johnson & K. Hill (Eds.), *Ecology and Design: Frameworks for Learning* (271-304). Washington, Covelo, London: Island Press.

Louisiana State University Sea Grant. (n.d.) *The Life Cycle of a Shrimp*. Retrieved from <http://www.lsu.edu/seagrantfish/biological/shrimpniche.htm>

Mathur, A. & de Cunha, D. (2001). *Mississippi floods*. Yale University Press.

McLindon, C. (2015). *Rethinking coastal restoration: The delta cycle and land area change in the Louisiana coastal plain*. Retrieved from [http://biotech.law.lsu.edu/climate/docs/The\\_Delta\\_Cycle\\_and\\_Land\\_Area\\_Change\\_in\\_Coastal\\_Louisiana.pptx](http://biotech.law.lsu.edu/climate/docs/The_Delta_Cycle_and_Land_Area_Change_in_Coastal_Louisiana.pptx)

Milligan, B. (June 2015). Landscape migration. *Places Journal*. Retrieved from <https://placesjournal.org/article/landscape-migration/>

Misrach, R. & Orff, K. (2014). *Petrochemical America*. Aperture.

Muncy, R.J. 1984. *Species profiles: life histories and environmental requirements of coastal fisheries and invertebrates (Gulf of Mexico) – white shrimp*. U.S. Fish and Wildlife Service and U.S. Army Corps of Engineers.

Online Etymology Dictionary. (2015). *Aesthetic*. Retrieved from <http://www.etymonline.com/index.php?term=aesthetic>.

Oxford Dictionaries. (2016). *Aesthetic*. Retrieved from <http://www.oxforddictionaries.com/definition/english/aesthetic>.

Steyer, G.D. (2010). Coastwide Reference Monitoring System (CRMS): U.S. Geological Survey Fact Sheet 2010-3018, 2 p. (Revised August 2010)

### **Sarah Schramm**

Sarah Schramm has a B.S. in Biology from the University of Wisconsin-Madison (2006) and a MLA from the University of Virginia (2014). She has worked as a research specialist in entomology extension at the University of Wisconsin-Madison and is currently working at the Louisiana State University Coastal Sustainability Studio. Her research interests include visualization techniques that inspire action and urban design strategies that allow cities to accommodate temporary expansion in population related to hurricane evacuees.

### **Jacob Mitchell**

Jacob Mitchell is a landscape designer, visualization specialist, and researcher whose work focuses on the convergence of landscape processes, infrastructural systems, public space, and representation. He is an Assistant Professor (Research) at Louisiana State University's Coastal Sustainability Studio where he

leads the development of a visualization program for the State of Louisiana's Coastal Protection and Restoration Authority. Holding a Master of Landscape Architecture from the University of Toronto, and a Bachelor of Environmental Studies from York University, his research endeavours include the development of design methods using remote sensing technology and geographic information systems to apply quantitative landscape analysis to site design.

**Jeff Carney**

Jeff Carney AICP, AIA, is Associate Professor at the LSU School of Architecture and Director of the Coastal Sustainability Studio (CSS). Jeff's work in Louisiana centers on trans-disciplinary efforts to plan and design in the dynamic Gulf Coast Environment. Jeff received his BA from Washington University in St. Louis and master's degrees in both city and regional planning and architecture from the University of California, Berkeley. As director of the CSS for the past 5 years he recently directed the Mayors' Institute on City Design's 2013 Southern Regional session, was a team leader in the Changing Course Competition, and is currently leading development of a visualization program with the Coastal Protection and Restoration Authority.

# **AN ECOLOGICAL GREENWAY STUDIO PLANNING AND DESIGN PROCESS USING WILDLIFE HABITAT RELATIONSHIPS (WHR) MODELS FOR THREE CASE STUDIES OF RIVERS IN THE CENTRAL VALLEY OF CALIFORNIA**

**GRECO, STEVEN**

Professor & Chair, Landscape Architecture and Environmental Design Program, University of California, Davis.

## **1 ABSTRACT**

*The purpose of this paper is to describe an 'ecological greenway' design process using WHR models within a landscape planning and design studio context by examining three river case studies. WHR modeling is species-specific information that links vegetation communities, and their structure, to wildlife species suitability models (Beck & Suring, 2009). Without incorporating WHR models to predict functionality for wildlife species of concern (e.g. threatened or endangered) it is unlikely the greenway will function for them. For example, the ecological greenway design process described by Hellmund & Smith (2006) does not incorporate WHR models. A dilemma in greenway planning is justifying the width. Herein, width is governed by ecological function: a migration corridor for deer and habitat for endangered species. Each river is situated within a primarily agricultural landscape matrix and none function as a deer migration corridor. Each river's floodplain is significantly fragmented and constrained by human land uses. The goals of the projects were to enhance and restore ecological functionality and provide limited-impact human recreation (e.g. hiking and biking).*

*Students implemented an integrated dual-track design process, one track focused on natural systems and the other on cultural systems. An emphasis within natural systems was conservation planning and design using a set of 'focal species'; one of which was a wide ranging and seasonally migrating ungulate to create an "umbrella effect." To design habitat areas for each focal species, a California-specific WHR system was utilized (Mayer & Laudenslayer, 1988). Local open space, cultural history, and recreational goals formed the basis of the cultural systems design process. Students created a GIS database for each case study by collecting a variety of GIS data layers including land use, land cover, roads, 100-year floodplain, and soils. Techniques utilizing GIS, CAD, and illustration software were combined to create site analyses and master plans.*

*Master plan designs were dependent on the individual river systems but had many commonalities in their landscape patterns due to the common criterion of creating a deer migration corridor. Phasing of the alignment width was key to achieving ecological functionality in the long-term. GIS was used effectively to communicate phasing in an animated sequence.*

*Ecological greenways are important habitat resources for wildlife in culturally-dominated landscapes, especially where migrating or endangered species are present. The use of WHR models is important to the design process to ensure the landscape patterns of the greenway function for the wildlife species it was designed for.*

## 1.1 Keywords

Ecological greenway; wildlife habitat relationships; habitat design; migration corridor; rivers

## 1 INTRODUCTION

Ensuring that greenways are designed to serve ecological functions and meet the habitat requirements of specific wildlife species is the focus of this paper. A very important tool for greenway designers is the utilization of wildlife habitat relationships (WHR) models. WHR modeling is species-specific information that links the composition of vegetation communities and their structure to wildlife species suitability models (Beck & Suring, 2009; Morrison, Marcot, & Mannan, 2012). Without considering or incorporating WHR models into a design process to "build-in" or "predict" functionality for wildlife species of concern (e.g. threatened or endangered), it is unlikely the greenway will effectively function for them. Unfortunately, this basic method to conceptualize and design functional habitat is missing from most major textbooks in landscape architecture and environmental planning. The WHR literature remains primarily in highly specialized articles and books on wildlife habitat analysis. However, a paradox exists because some literature in landscape architecture (such as Ndubisi, 2002; Verboom & Pouwels, 2004) actually address *advanced uses* of WHR models in the context of metapopulation analysis and modeling population viability. It appears these methods (e.g., using LARCH or LANDEP) tend to be used more by ecological scientists and less by environmental designers and planners. Thus, there remains an important knowledge gap at the undergraduate (introductory) level of the basic concepts of WHR and how it can be used to design functional wildlife habitat. This issue is further addressed in the Discussion.

The objectives of this paper are: (1) to describe the basic concept of WHR and how it can be used in habitat evaluation and design, conservation planning, and greenway design in a studio course context; (2) to describe a planning and design process and show some products of a series



of undergraduate greenway design studio courses using WHR methods on three California river systems; and (3) to review the literature in landscape architecture (both educational textbooks and journal articles) regarding WHR concepts and methods.

### 1.1 What is WHR, how is it measured, and how is it used?

Wildlife habitat is a species-specific concept, meaning habitat types, such as vegetation communities and other land cover, have different suitability values for each species (Beck & Suring, 2009; Verboom & Pouwels, 2004). WHR models describe the ecological needs of *individual species* by breaking down habitat into various life history functional units (or "life requisites") such as feeding habitat, cover habitat, and reproductive habitat (Cooperrider, 1986). WHR is an extension of ecological niche theory. Habitat is often represented as a land cover (choropleth) map typically using a floristically coarse classification system of vegetation communities. Each of the three life requisite variables are separately scored for suitability (on a scale from zero to 1.0; see section 1.3 below for more detail) and three scores can then be averaged or weighted (mathematically combined) into a single habitat suitability index (HSI or SI) score. There are many metrics to combine the separate habitat scores, but two widely used metrics are the arithmetic and geometric means (statistical averages) as shown below:

$$SI = \frac{R+C+F}{3} \quad (1)$$

$$SI = \sqrt[3]{R \times C \times F} \quad (2)$$

where *SI* is the suitability index for a particular wildlife species at a site and *R* is reproduction habitat, *C* is cover habitat, and *F* is feeding habitat. Equation 2 is a more conservative metric because if any of the life requisite variables is rated as zero then the entire SI score is zero. It should be noted that the suitability scores (or ratings) of each life requisite habitat type are usually

designated by species experts or by scientific studies of habitat preference; they are empirical estimates based on the best available information.

The following example illustrates this overall approach. If a species at a particular site has feeding habitat rated as 1.0 (excellent feeding habitat), cover habitat rated as 0.66 (medium), and the site lacks any reproductive habitat (i.e., the SI = 0; or unsuitable), then its arithmetic mean is 0.55 and its geometric mean is zero. If population persistence at the site is a management imperative then the latter metric (Equation 2) is more appropriate.

Another important aspect of WHR models is the presence of certain "habitat elements" at a site that are essential for a species survival and persistence, for example snags for late-seral cavity nesting birds or rock piles for most reptiles. Such habitat elements may not be mapped easily using GIS land cover data and therefore its presence is often confirmed by field visits to the site in question.

WHR models can be used for many purposes. Often they are used to predict which wildlife species could potentially be present at a site, a method commonly employed in habitat conservation plans (HCPs; implemented under the federal Endangered Species Act; see Noss, O'Connell, & Murphey, 1997). Another application for WHR models is for estimating impacts in environmental impact statements (EISs; implemented under the federal National Environmental Policy Act) by predicting the potential loss of habitat and species associated with those habitats due to development or timber harvest. A third application is for designing functional habitat (using patch composition and habitat elements) for focal species or species of special concern. WHR models can also be used to infer ecological processes such as seasonal migration and juvenile dispersal for wildlife species with those needs. Maintaining processes such as these is a great challenge in conservation planning. For wide ranging generalist species such as most ungulates, WHR models



can be used to design contiguous habitats, commonly referred to as "wildlife corridors" where habitat connectivity is essential. Functional connectivity (as opposed to structural connectivity) means that the corridor is composed of habitat types that a species has been observed using to migrate, thus "connectivity is both species- and landscape-specific" (Noss, 2006, p. 71 citing Bennett, 1999).

## **1.2 The greenway width dilemma**

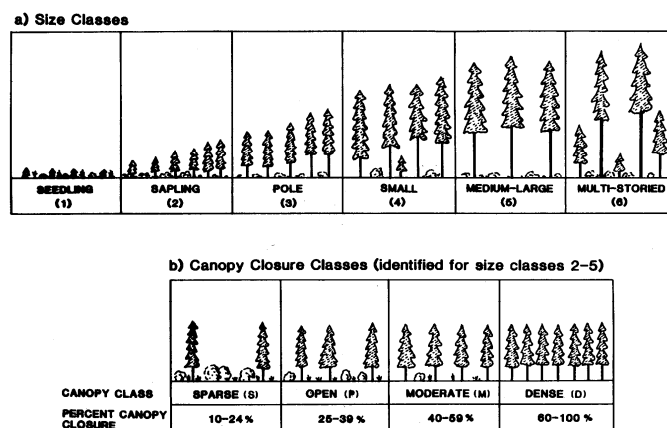
A common dilemma in greenway planning is justifying the areal width of the park's alignment. In the case studies presented below, greenway width is determined by the ecological function of a seasonal migration corridor for a wide ranging ungulate species and habitat for endangered species. Suitable habitat types were identified using a WHR system designed for California wildlife species. Spatial dimensions and configuration of the migration corridor was derived from a species-specific spatial study of migration (see section 2.2 below for further discussion). Another criterion for determining greenway width on a river system is using flood frequency, in particular, the boundary of the 100-year recurrence interval (Greco & Larsen, 2014).

## **1.3 WHR systems**

There are numerous WHR modeling systems that have been developed in the U.S. and worldwide. For example see the Oregon and Washington state WHR system (Johnson & O'Neil, 2001). This paper mainly focuses on the California Wildlife Habitat Relationships (CWHR) system that was first developed in the 1980s to describe habitat use by all terrestrial vertebrates in the state (Mayer & Laudenslayer, 1988). Currently the database system has 712 species represented as WHR models including all birds, mammals, reptiles, and amphibians. The database is a stand-alone

program for Windows-based PC computers and is now free and available to the public through the California Department of Fish and Wildlife website along with multiple support documents (see <https://www.dfg.ca.gov/biogeodata/cwhr/>). The current version (CWHR v9.0) was recently released and runs on Windows 8 and accommodates 64-bit computing (CDFW & CIWTG, 2014).

The CWHR system classifies habitats into seven tables of broad categories of major habitat types: (1) trees, (2) shrubs, (3) herbaceous, (4) tree-shrub, (5) aquatic, (6) agricultural, and (7) other habitat (urban and barren). Within each major habitat type, multiple vegetation communities are broken down into structural classes (combining size classes with cover classes; see Figure 1 for tree habitats).



**Figure 1:** Vegetation (tree habitats) size classes and canopy cover classes (habitat stages) in the CWHR system (from Airola, 1988).

For example, the tree habitats table (matrix; Table 1) has 23 tree habitats (i.e., vegetation communities dominated by trees) and each tree habitat is broken down into 17 structural stages ranging from seedlings to medium/large trees. The tree habitats have six size classes (1-6) and four cover classes (sparse, open, medium, dense) that are combined to create up to 17 structural classes per vegetation community (most have 16 structural types; see Table 1). Each box with a dot in its center in Table 1 is rated by species experts using empirical studies for habitat suitability (high =

1.0, medium = 0.66, low = 0.33, and unsuitable = 0) for feeding, reproduction, and feeding for each of the species in the database (Figure 2). These three ratings can be combined using Equation 1 or 2, above, to evaluate an overall habitat rating (see Table 2 for an example using Equation 1). Each of the other six broad categories of major habitat types (shrubs, herbaceous, tree-shrub, aquatic, agricultural, and "other" habitat) are also broken down into structure/cover categories, though fewer than the trees, and rated for each species' suitability. Thus, each species' WHR model includes all the habitat types it uses and reflects the quality of each habitat for the species. Importantly, WHR habitats can be mapped as land cover using a GIS (Figure 3). The last component of each model is a list of habitat elements either required or preferred by the species.

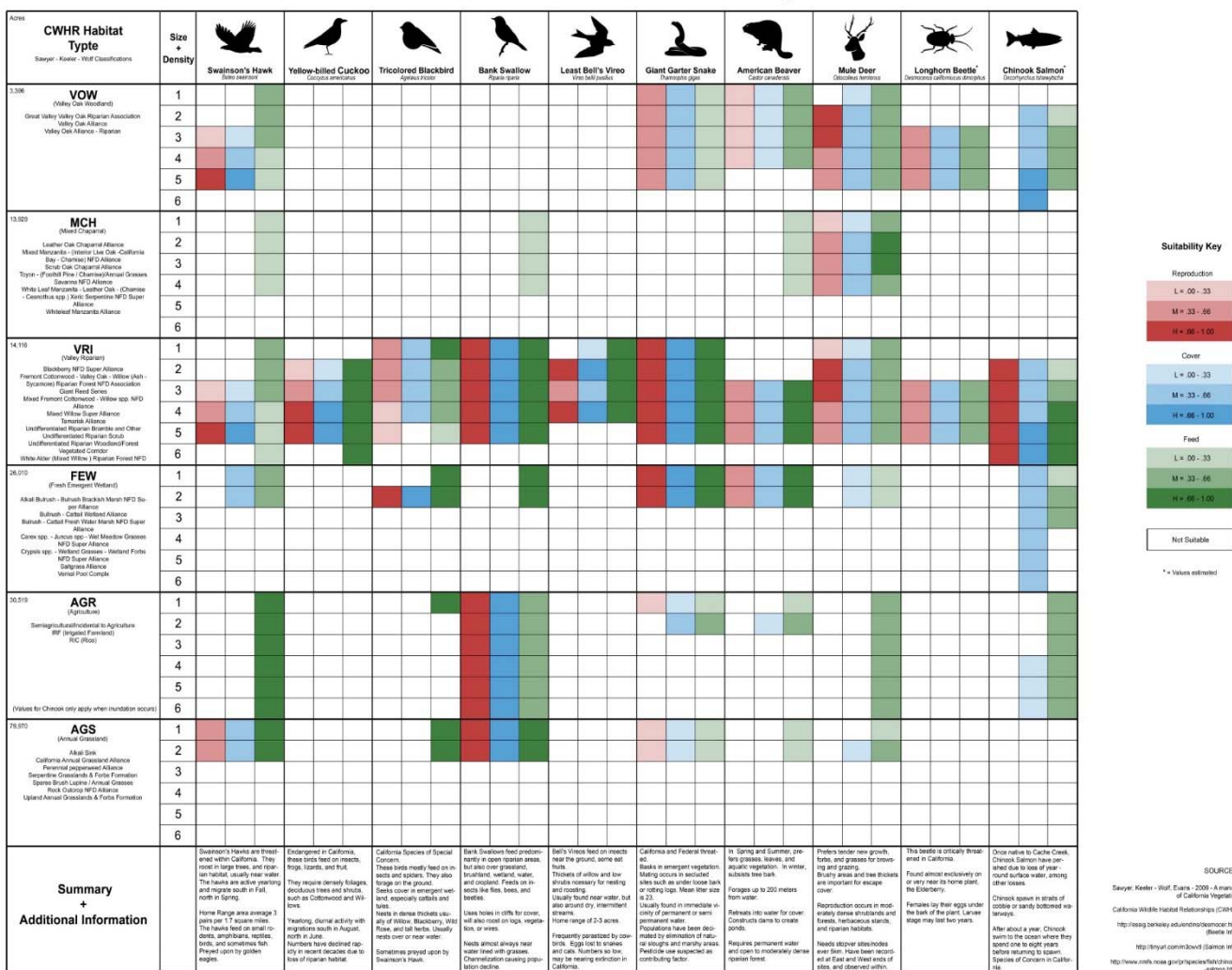
**Table 1:** Tree habitat matrix from the CWHR system and standards for tree size classes and canopy closure classes (below the matrix) (from Mayer & Laudenslayer, 1988).

Table 1. Available Habitat Stages For Tree Dominated Habitats																												
Tree Habitat			Habitat Stage																									
			1	2S	2P	2M	2D	3S	3P	3M	3D	4S	4P	4M	4D	5S	5P	5M	5D	6								
SCN	Subalpine Conifer		•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
RFR	Red Fir		•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
LPN	Lodgepole Pine		•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
SMC	Sierran Mixed Conifer		•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
WFR	White Fir		•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
KMC	Klamath Mixed Conifer		•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
DFR	Douglas-Fir		•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
JPN	Jeffrey Pine		•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
PPN	Ponderosa Pine		•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
EPN	Eastside Pine		•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
RDW	Redwood		•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
PJN	Pinyon-Juniper		•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
JUN	Juniper		•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
CPC	Closed-Cone Pine-Cypress		•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
ASP	Aspen		•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
MHC	Montane Hardwood-Conifer		•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
MHW	Montane Hardwood		•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
BOW	Blue Oak Woodland		•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
BOP	Blue Oak—Digger Pine		•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
VOW	Valley Oak Woodland		•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
COW	Coastal Oak Woodland		•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
MRI	Montane Riparian		•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
VRI	Valley Foothill Riparian		•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
Standards For Tree Size													Standards For Canopy Closure															
WHR	WHR Size Class	Conifer Crown Diameter	Hardwood Crown Diameter	dbh									WHR	WHR Closure Class									Ground Cover (canopy Closure)					
1	Seedling Tree	n/a	n/a	<1"									S	Sparse Cover									10-24%					
2	Sapling Tree	n/a	<15"	1"-6"									P	Open Cover									25-39%					
3	Pole Tree	<12'	15'-30'	6"-11"									M	Moderate Cover									40-59%					
4	Small Tree	12'-24'	30'-45'	11"-24"									D	Dense Cover									60-100%					
5	Medium/Large Tree	>24'	>45'	>24"																								
6	Multi-Layered Tree	Size class 5 trees over a distinct layer of size class 4 or 3 trees, total tree canopy exceeds 60% closure																										

#### **1.4 WHR systems and vegetation classification**

An important conceptual component of WHR systems is its use of land cover maps, and in particular, vegetation classification systems. To use WHR systems effectively the pedagogy of understanding and applying classification crosswalks between databases is essential. WHR systems tend to use broadly classified vegetation communities to describe habitat types. As such these broadly defined communities usually contain many different vegetation alliances and plant associations. A "crosswalk" defines equivalent classes between tabular database systems to perform reclassification (Woolmer, 2010). Commonly, land cover datasets are mapped using different classes than a WHR system uses and therefore a crosswalk is necessary to define the WHR types from the land cover types. For example, in the CWHR system, the "valley/foothill riparian" (with the acronym "VRI") tree habitat type consists of many riparian plant community alliances and associations, such as various cottonwood and willow alliances and associations. If a land cover map is created using more floristically resolved alliances or associations, then they must be redefined (i.e. generalized) as VRI using a database crosswalk table that defines these equivalent classes. Crosswalks are implemented using a table join function in a GIS. Crosswalks are sometimes provided for commonly used land cover systems to facilitate use of the WHR system (for an example see Mayer & Laudenslayer, 1988, p. 26; Sawyer, Keeler-Wolf, & Evens, 2009).

## Cache Creek Habitat Suitability Matrix



**Figure 2:** Selected focal species to act as an umbrella for the Cache Creek Greenway near the city of Woodland. An example of student studio work (from Student Group 2015b). Colors (hue) show feeding, cover and reproductive habitats and value reflects habitat quality (darker equals higher suitability).

## 2 METHODS

## 2.1 Studio course overview and structure

Three undergraduate senior-level studio courses were taught at UC Davis in the winter quarters of 2010, 2012, and 2015 (see Acknowledgements section) examining three different

**Table 2:** Combined suitability values of CWHR habitat types for a suite of focal species for greenway planning and design. An example of student studio work (from Student Group 2012a).

Species			Species Habitat Suitability Index																																
Common Name	Scientific Name	Habitat Type	Habitat																																
			1	2s	2p	2m	2d	3s	3p	3m	3d	4s	4p	4m	4d	5s	5p	5m	5d																
Mule Deer	<i>Odocoileus hemionus</i>	Blue Oak Woodland	L	H	H	M	M	H	H	H	M	M	M	H	H	M	M	M	M	M															
		Valley Foothill Riparian	M	H	H	M	M	H	H	H	M	M	M	H	H	M	M	M	M	M	M														
		Valley Oak Woodland	L	H	H	M	M	H	H	H	M	M	M	M	H	H	M	M	M	M	M														
Giant Garter Snake	<i>Thamnophis gigas</i>	Valley Foothill Riparian	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H															
		Valley Oak Woodland	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M														
		Valley Oak Woodland	L	L	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M														
Yellow-Billed Cuckoo	<i>Coccyzus americanus</i>	Valley Foothill Riparian	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H															
		Valley Oak Woodland	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M														
		Valley Oak Woodland	L	L	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M														
Yellow Warbler	<i>Dendroica petechia</i>	Valley Oak Woodland	L	L	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M															
		Blue Oak Woodland	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M														
		Valley Foothill Riparian	N/A	M	H	H	H	H	H	H	H	H	H	H	H	H	M	M	M	M	M														
Northern River Otter	<i>Lontra canadensis</i>	Valley Oak Woodland	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M															
		Valley Oak Woodland	L	H	H	H	H	H	H	H	H	H	L	H	H	H	L	H	H	H	H														
		Valley Foothill Riparian	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H														
Bank Swallow	<i>Riparia riparia</i>	Blue Oak Woodland	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H															
		Valley Foothill Riparian	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H															
		Valley Oak Woodland	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H															
Peregrine Falcon	<i>Falco peregrinus</i>	Blue Oak Woodland	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H															
		Valley Foothill Riparian	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H															
		Valley Oak Woodland	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H															
Bank Swallow	<i>Riparia riparia</i>	Riverine	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L															
		Riverine	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L															
		Riverine	L	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M														
		Riverine	N/A	M	M	M	M	M	M	M	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A														
Peregrine Falcon	<i>Falco peregrinus</i>	Riverine	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L															
		Riverine	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L															
		Riverine	L	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M														
		Riverine	N/A	M	M	M	M	M	M	M	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A														
Giant Garter Snake	<i>Thamnophis gigas</i>	Riverine	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L															
		Riverine	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L															
		Riverine	L	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M														
		Riverine	N/A	M	M	M	M	M	M	M	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A														
Northern River Otter	<i>Lontra canadensis</i>	Riverine	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L															
		Riverine	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L															
		Riverine	L	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M														
		Riverine	N/A	M	M	M	M	M	M	M	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A														
Bank Swallow	<i>Riparia riparia</i>	Annual Grassland	15	1P	1M	1D	25	2P	2M	2D	3M	3D	3S	3P	3M	3D	3S	3P	3M	3D															
		Fresh Emergent Wetland	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H															
		Annual Grassland	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L															
		Fresh Emergent Wetland	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H															
Peregrine Falcon	<i>Falco peregrinus</i>	Annual Grassland	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M															
		Fresh Emergent Wetland	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M															
		Annual Grassland	L	L	M	M	L	M	M	M	M	M	M	M	M	M	M	M	M	M															
		Fresh Emergent Wetland	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L															
Mule Deer	<i>Odocoileus hemionus</i>	Annual Grassland	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L															
		Fresh Emergent Wetland	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H															
		Annual Grassland	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L															
		Fresh Emergent Wetland	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H															

LEGEND:

High Habitat Suitability (.66-1.0)

Medium Habitat Suitability (.33-.66)

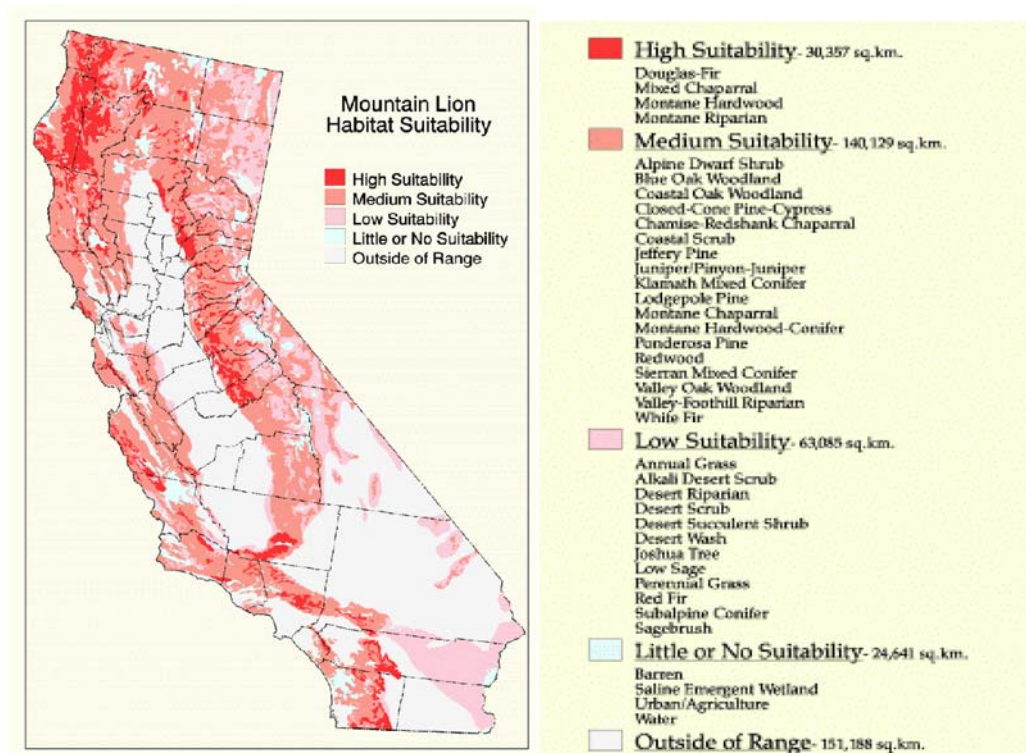
Low Habitat Suitability (.00-.33)

LEGEND:

High Habitat Suitability (.66-1.0)

Medium Habitat Suitability (.33-.66)

Low Habitat Suitability (.00-.33)



**Figure 3:** An example of WHR mapping. The habitat types and habitat suitability map of mountain lions in the state of California from the CWHR system (from the California Department of Fish and Wildlife, Biogeographic Data Branch).

river systems (each about 30 miles in length) in the Central Valley of California to create regional greenways to connect the valley floor to the higher elevation foothill and mountain landscapes (source areas for native ungulates). The three river systems were: (1) the Stanislaus River, a west-side tributary to the San Joaquin River in the San Joaquin Valley connecting to the Sierra Nevada mountains, (2) Putah Creek, an east-side tributary to the Sacramento River in the Sacramento Valley connecting to the Coast Range mountains, and (3) Cache Creek also an east-side tributary to the Sacramento River in the Sacramento Valley connecting to the Coast Range mountains.

The goals of the projects were: (1) to facilitate seasonal migration between the valley and mountain ranges by a wide ranging ungulate, the mule deer (*Odocoileus hemionus*), (2) to provide

sustainable habitat for other local wildlife and plant communities (using a coarse and fine filter approach), including special status species, such as species listed as threatened or endangered under the federal and state Endangered Species Acts, and (3) to provide recreation opportunities, including hiking trails and a regional bicycle trail. Each river is situated within a primarily agricultural landscape matrix and none currently function as a deer migration corridor, though they had historically. Each river's floodplain is significantly fragmented and constrained by human land uses. Overall, the goals of the projects were to enhance and restore ecological functionality and provide limited-impact human recreation.

The main pedagogical objectives of these projects were to apply the principles of WHR, landscape ecology, and conservation planning to real world landscapes in the Central Valley (near UC Davis), including the cities and towns, and the surrounding agricultural landscape matrix near the rivers. The learning objectives were to:

- Examine a landscape system and ecological issues at a regional scale;
- Utilize WHR models to design functional habitat for an ecological greenway;
- Select focal species and focal habitats for planning and design (coarse and fine filter);
- Use GIS to construct a spatial database (including the use of a crosswalk);
- Design low-impact recreational facilities;
- Depict the phased implementation of the greenway.

Each student in the studio courses volunteered to participate in two teams: an information team and a design team. The information teams were divided into three topical research areas: natural systems, cultural systems, and database construction. Each design team consisted of at least one member from each information team topical area. Thus, each design team had 5-6 students with at least one representative from natural systems, one from cultural systems, and one from database



construction. The information teams performed the inventory, some preliminary analyses, and constructed a collective database for all the design teams to utilize. Subsequently, the design teams performed additional analyses and prepared greenway alignment alternatives and selected a final alignment with phasing for their master plan.

These projects examined landscape structure and function for natural and cultural systems, however, it emphasized analysis and planning for natural systems. Each class collected a variety of information types and developed a GIS database of existing spatial data and additional data layers were developed by students. Using these data each team of students followed a design process to: (1) conduct an inventory by summarizing important GIS layer variables, such as land use and land cover, including performing a crosswalk to WHR classes; (2) conduct a site analysis for a set of target focal species (using a multi-species umbrella approach; see section 2.2 below) in the river's region by identifying existing and potential source habitat areas, corridors, barriers, and sink habitats; (3) conduct a site analysis for public access and recreation; and (4) create a coordinated conservation greenway (or “ecological network”) master plan that incorporates the opportunities and constraints identified in the site analyses.

The studio courses were 10 weeks in length and the studio project described above was completed in the first six weeks and a second studio project followed it lasting four weeks. The second project had the students choose key nodes on their greenway alignment and they worked at a more detailed site scale to design habitat patches and recreational facilities. Typically, the second project also involved designing a wetland (for storm water or for tertiary waste water treatment) within one of the greenway nodes. The wetland design required a topographic grading plan, planting plan, and detailed trail design that reflected design concepts to minimize conflict between

people and wildlife based on the work of Cole (1993), Hellmund (1998), and Flink & Searns (1993).

## **2.2 A note on focal species and the multi-species umbrella approach**

There are many approaches to selecting species for biodiversity planning (i.e., the 'fine filter') including: indicator species, charismatic species, flagship species, umbrella species, focal species, vulnerable species, ecological engineers, keystone species, economically valuable species, link species, narrow endemic species, phylogenetically distinct species, and special cases (Ahern, Leduc, & York, 2006; Noon & Dale, 2002; Noss et al., 1997). Often a variety of these methods are combined for a particular conservation project.

A widely cited and popular approach is the selection of a multi-species umbrella of focal species that meet a spectrum of ecological criteria (Lambeck, 1997). In this approach Lambeck argues that a suite of focal species be selected based on key ecological limitations such that, as a whole, they protect all or most other species in the respective landscape (i.e., the umbrella effect). In this scheme species are selected based on whether a species' needs require reconstruction of habitat (restoration) or whether a species needs land management actions to recover the population. The species that need habitat restoration are species that are area-limited, dispersal-limited, or resource-limited, while the species that need land management are typically process-limited and may require removal of exotic predators or weeds, or the addition of prescribed fire or cattle grazing.

This approach has been criticized for the assumption of nested-niches, or "nestedness," meaning that life history requirements of multiple species cannot be assumed to entirely overlap (Lindenmayer, Manning, Smith, Possingham, Fischer, Oliver, & McCarthy, 2002). However, as

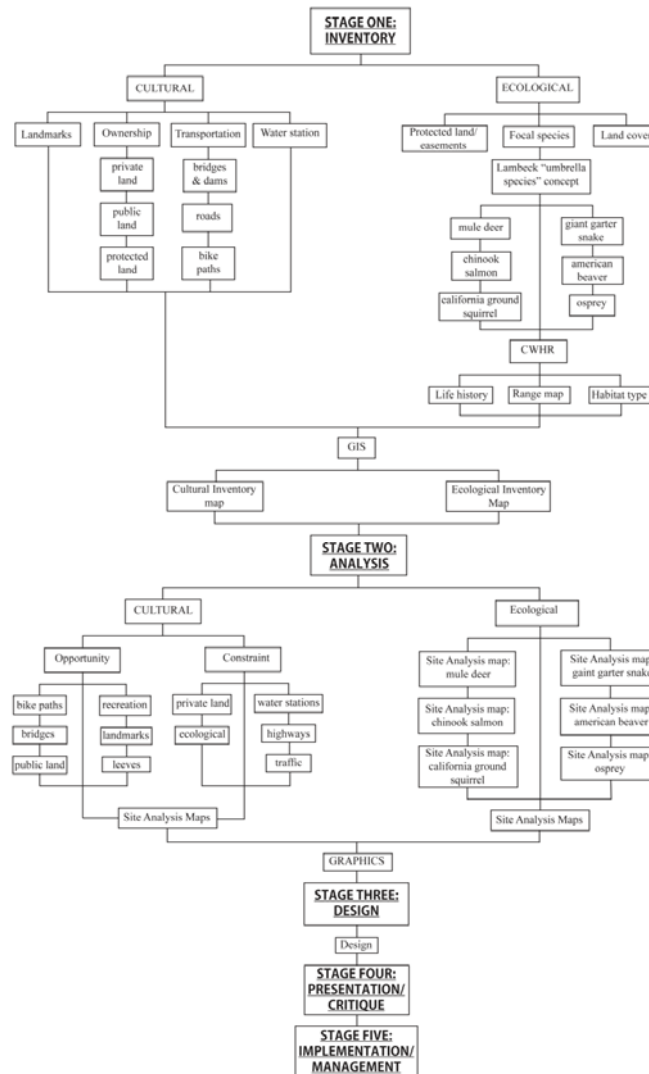
Noon & Dale (2002) point out, it is *impossible* to monitor and assess the viability for all species at a site, especially for large regions, and therefore it is necessary to pick a subset of species for this purpose. In a response to Lindenmayer et al. (2002), a rebuttal by Lambeck (2002) states that despite the theoretical limitations of the umbrella concept, his method is the best approach because it is practical and effective, given limited funding and resources for species recovery planning and monitoring. It is important to note that the use of a WHR system can be a powerful tool to compare and group species based on their common niche requirements and identify those that do not meet the assumption of nested-niches. Cooperrider (1986) points out that WHR models can facilitate identifying guilds (i.e., groups that feed on similar food types).

For the studio course, students were instructed to use the CWHR system to select representative focal species for each of the major habitat types in the study areas including threatened or endangered species. As discussed above the students also had to include the mule deer as their wide ranging ungulate species. To determine the spatial parameters for the configuration of the seasonal migration corridor the students used a detailed study mule deer migration by Sawyer, Kauffman, Nielson, & Horne (2009). The students then modeled the habitat of each species in a GIS using a land cover data set and combined all species together into a single suitability map reflecting all species (Store & Jokimaki, 2003).

### **3 RESULTS**

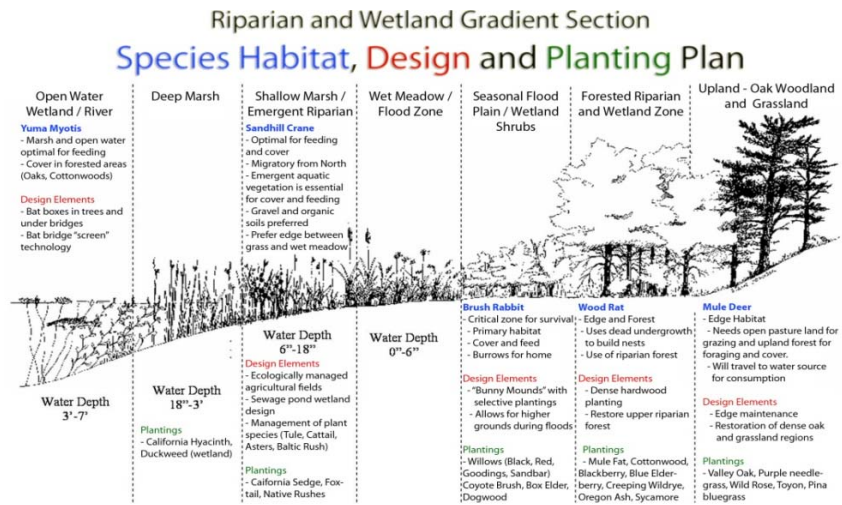
The results in this paper are sample products from the student group work from the planning and design studios described above (see the Acknowledgements section for credits). The studio products demonstrate that undergraduate students can readily understand and implement WHR models for conservation planning and greenway design projects. The CWHR models for a set of

focal species representing an umbrella for a river system are shown in Figure 2 and Table 2 above. A sample design process flow chart depicting a dual-track natural-cultural systems approach is shown in Figure 4.

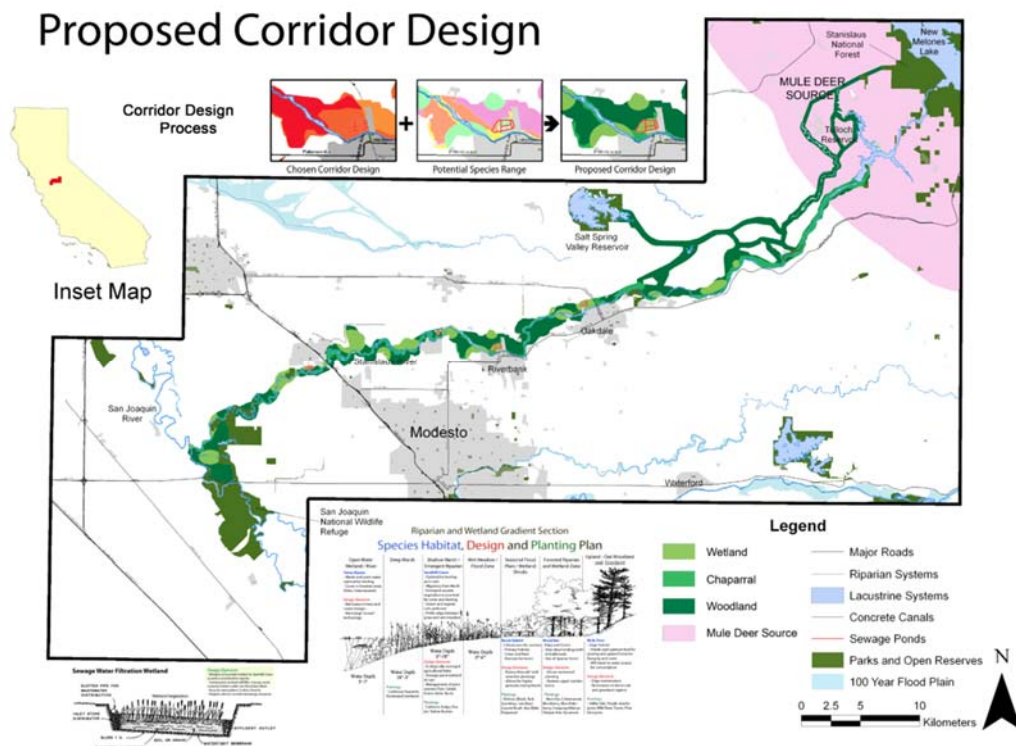


**Figure 4:** A dual track ecological-cultural design process for greenway planning and design. An example of student studio work (from Student Group 2012b).

A representative cross-section and master plan for the Stanislaus River (2010 studio) are shown in Figure 5 and Figure 6, respectively. The master plan depicts the final phase, configuration, and



**Figure 5:** Representative cross-section and schematic for species habitats to guide planting design. An example of student studio work (from Student Group 2010).



**Figure 6:** Master plan showing all phases of the ecological greenway on the Stanislaus River near the cities of Modesto, Riverbank, and Oakdale. An example of student studio work (from Student Group 2010).

18



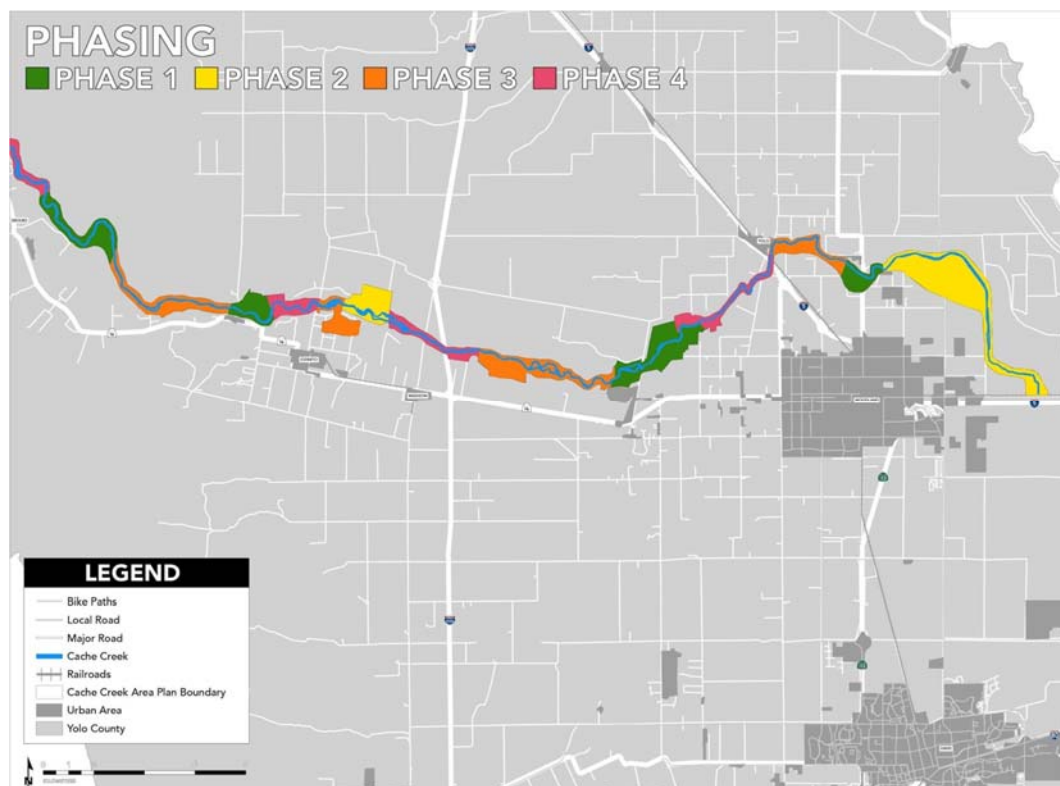
Two example master plans are presented from the Cache Creek studio in 2015. The first example depicts a representative cross-section of the floodplain habitats and the interrelationships of the habitats and the focal species (Figure 8), while the master plan illustrates the spatial configuration and four-part implementation phasing (Figure 9). The second example also well describes the

configuration, phasing and recreational facilities, including a regional bicycle trail and numerous other activities (Figure 10).



**Figure 8:** The interrelationships between different wildlife habitat relationships for 11 focal species for the

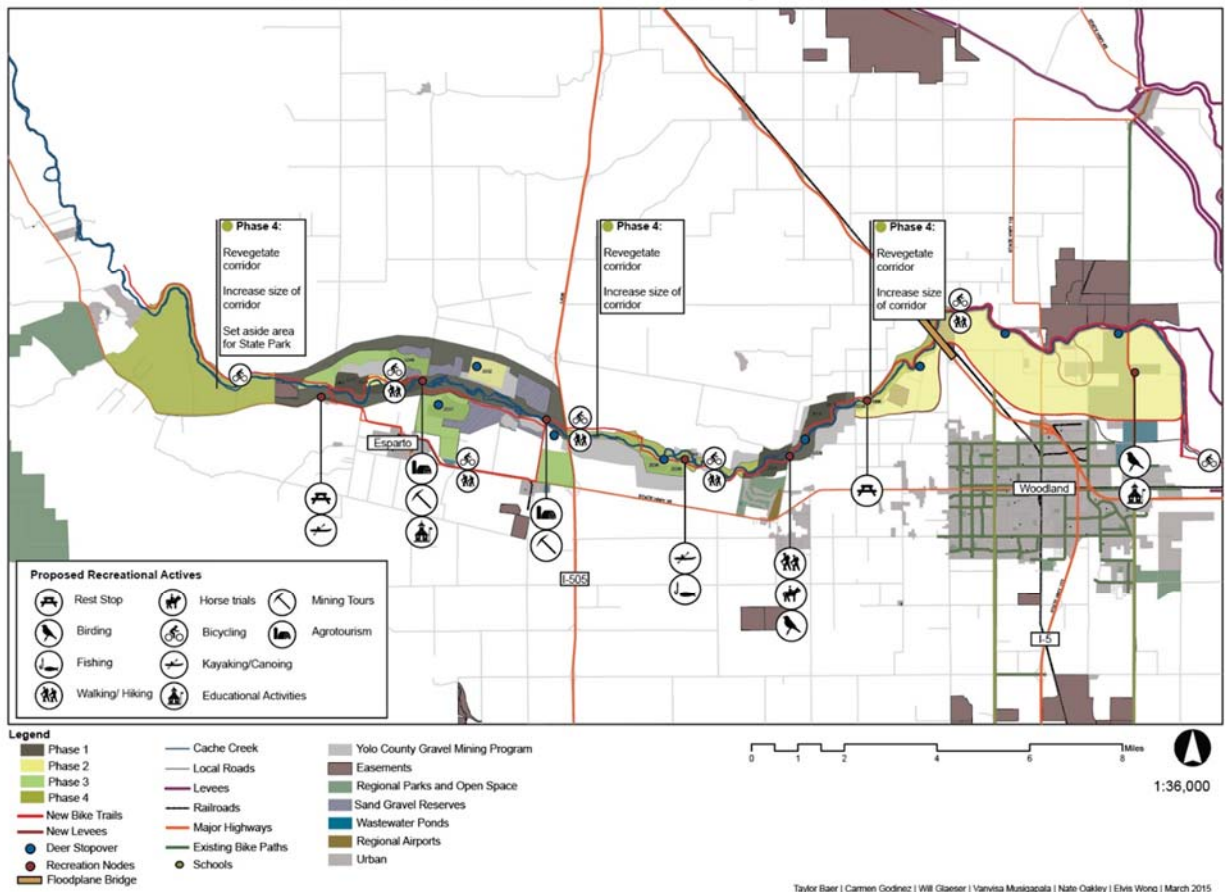
Cache Creek greenway project. An example of student studio work (from Student Group 2015a).



**Figure 9:** Master plan showing each phase (color) of the ecological greenway on lower Cache Creek near the city of Woodland. An example of student studio work (from Student Group 2015a).



## Lower Cache Creek Parkway Master Plan



**Figure 10:** Master plan showing each phase of the ecological greenway and recreational opportunities in each zone on lower Cache Creek near the city of Woodland. An example of student studio work (from Student Group 2015b).

## 4 DISCUSSION

There is a distinct lack of discussion of the basic concepts of WHR by leaders in the field of environmental design in nearly all the major educational textbooks. This dearth of information on what WHR is and how it can be used is puzzling given its relative simplicity and its potential power as an assessment and ecological design tool. Why might this be the case? The first speculative reason for this could be its regional nature, that WHR systems are place-based, meaning the WHR models apply to vegetation communities and land cover specific to a particular geographic region.



The California WHR system was first released in the late 1980s (Mayer and Laudenslayer, 1988) with its precursor publication focused on the Sierra Nevada mountains by Verner & Boss (1980). California has one of the most advanced systems in the nation, though other geographic areas also have fairly well-developed systems such as the states of Oregon and Washington (see Johnson & O'Neil, 2001). Another speculative reason for the lack of WHR discussion in the textbooks in the field of environmental design is perhaps the concept and method is too 'new' since the first major books on the topic were published in the mid-1980s (Verner, Morrison & Ralph, 1984) and early 1990s (Morrison, Marcot, & Mannon, 1992). The next major publication in this research realm was entitled *Predicting Species Occurrences: Issues of Accuracy and Scale* (Scott, Heglund, Samson, Haufler, Morrison, Raphael, & Wall, 2002). I co-authored a chapter in that book showing how a WHR model could be used to retrospectively map (postdict) habitat quality over a 60-year time period (1937-1997) using a decadal interval, for an endangered bird species and quantify the shifting habitat mosaic on a large meandering river (Greco, Plant & Barrett, 2002).

In my unsuccessful quest to find the WHR topic in educational textbooks of the environmental design field, I offer a very brief critique, meant as constructive criticism for improvement of future textbooks. The closest description of the WHR concept I could find in the landscape architecture educational textbook literature was in Steiner's (2000, p. 106) *Living Landscape* (second edition) in the section describing wildlife. The description did not use the term "WHR," however, and Steiner shows a good example of how different habitats are used for "eating" (feeding), "living" (cover), and "breeding" (reproduction) for each species presented in the species-habitat matrix. In the classic textbook by Marsh (2010) there is no explicit discussion of WHR models or how to use them for designing habitat for wildlife; in the section on "Vegetation as a Tool in Landscape Planning and Design" (Marsh, 2010, p. 414) the concept of designing wildlife habitat is entirely

missing, while seven other common themes are discussed mostly relating to human landscape functionality.

I was unable to find any references to the concept or use of WHR in Johnson & Hill's (2002) edited text on *Ecology and Design*. In Steinitz' (2002) contribution in that volume entitled, "On Teaching Ecological Principles to Designers," it is highly recommended that WHR modeling be added as a pedagogical objective in a core curriculum. The very useful mini-textbook entitled *Landscape Ecology Principles in Landscape Architecture and Land-Use Planning* by Dramstad, Olson, & Forman (1996), as well as Forman & Godron's (1986) and Forman's (1995) landmark texts on landscape ecology, also do not explicitly discuss WHR concepts. In Peck's (1998) book on *Planning for Biodiversity*, wildlife habitat models are briefly mentioned but are not given in-depth treatment. And in terms of greenway design textbooks and articles, neither the Hellmund & Smith (2006) text nor the now out-of-print book by Flink & Searns (1993) address the concept of WHR. The final chapter in the Hellmund & Smith (2006) textbook, however, shows how species movement habitat criteria can be incorporated into the greenway design process, which is valuable.

A review of the greenway research literature similarly yielded little information about habitat design using the WHR concept and methods. The compilation of papers by Fabos & Ahern (1995) from the *Landscape and Urban Planning* journal in the book *Greenways: The Beginning of an International Movement* is an excellent resource, however, it too lacks a discussion of WHR models. A section in that book addresses "Ecological resources and nature protection in greenway planning" (Fabos & Ahern, 1995, p. 157) and contains six articles that discuss many complex planning and design processes that refer to habitat analysis, for example in Burley's (1995) study, and structure and function, such as the modified abiotic-biotic-cultural (ABC) strategy described by Mdibisi, DeMeo, and Ditto (1995), which appear to implicitly refer to WHR attributes of habitat.

Interestingly, Burley (1989) published a paper that described the overall intent of HSI models but did not describe the underlying structure of WHR models.

In what seems somewhat paradoxical, as described above in the Introduction, there is some literature in the environmental design field that uses WHR models in a highly advanced form. An example of this is found in the book edited by Jongman & Pungetti (2004) entitled *Ecological Networks and Greenways: Concept, Design, and Implementation*. In that book a chapter by Verboom & Pouwels (2004) uses WHR models, again implicitly, to identify habitat for a suite of species to determine their population viability through time using the procedure known as LARCH (Landscape ecological Analysis and Rules for the Configuration of Habitats). Similarly, Ndubisi (2002) describes the use of the modeling systems LARCH and LANDEP (Landscape-Ecology-and-Optimization method) that use some form of WHR models at their core. Unfortunately, none of these articles, books, or book chapters describe the underlying WHR concept in its basic form or how it's used. It seems an assumption is made that the reader already understands the structure and use of WHR models and those models are then used to model habitats in a more or less black-box form and results are presented as maps or analyses.

From the discussion above there appears to be a pedagogical need for a middle ground description of the WHR concept and its application for habitat design for landscape architecture and environmental planning students at the undergraduate level. I have integrated the WHR concept into the curriculum of my undergraduate *Site Ecology* course (a combination of general ecology and site planning) and the advanced planning and design studio course that produced the results in this paper.

It is important to note that existing WHR systems are still evolving and being refined over time and new WHR systems are being invented for more geographic regions around the world. WHR is

a descriptive method and it is important to understand its limitations. For example, WHR models alone can only describe species spatial distribution and *not* abundance (Jennings, Csuti, & Scott, 1996). More advanced habitat evaluation systems use WHR as an input and build upon it, such as LARCH, that can add other parameters such as home range size, or territories, to estimate carrying capacity and population viability. The California WHR system, CWHR, is a well-developed database that describes habitat vegetation composition, vegetative structural attributes (i.e., size and density), and habitat elements, but, for example, the CWHR system lacks specifications for habitat spatial configurations, such as minimum patch size or corridor width. An improvement to the CWHR system would be the addition of a fourth habitat life requisite in addition to feeding, cover, and reproduction habitat. The fourth life requisite is 'movement habitat' and each habitat type/structural class in the system would be rated for each species for movement suitability or as a "cost" to movement (sometimes defined as  $1 - x$ , where  $x$  is the habitat suitability value for a particular land cover type). An example of this approach to model habitat connectivity to facilitate species movement was used in a study at the Stanislaus River site near Riverbank, California (Huber, Shilling, Thorne & Greco, 2012).

## **5 CONCLUSION**

The basic concept of WHR modeling is an important planning and design skill for landscape architects and environmental planners. It is a tool that helps implement landscape ecological theory and island biogeography theory. WHR has powerful applications in habitat design and conservation planning and should not be a technique that only wildlife biologists use and conduct research in. The theory and methods of WHR modeling are unfortunately absent, for the most-part, from the

educational textbooks in the field of landscape architecture and environmental design. In future revisions of these textbooks the concept should be included and examples provided.

This paper demonstrates that WHR concepts can be taught to undergraduate students and the students can design regional greenways using these and complementary methods. By using WHR methods the resultant greenway designs are more likely to perform the ecological functions intended to provide feeding, cover and reproductive habitat for a selected set of focal species.

## **ACKNOWLEDGEMENTS**

I wish to sincerely thank the students in the Landscape Architecture Program at UC Davis for the outstanding work they produced in my studio courses. The following student groups' studio work is featured in this article (see citations at tables and figures):

Student Group 2010 (Studio class LDA 181F): Gabino Marquez, Iain Pryor, Omar Sadik, Kathryn Salfen, & Choua Vue.

Student Group 2012a (Studio class LDA 181F): Nikita Choi, Philip Dinh, Jiwan Kim, Hannah Levy, Kelly Matheson, & Gary Ng.

Student Group 2012b (Studio class LDA 181F): Micheline Chagniot, Carson Cooper, Hoang-Lan Nguyen, Gabriel Munoz, Brooks Taylor, & Ying Ying Zhong.

Student Group 2015a (Studio class LDA 191): Evelyn Chang, Jonathan Chavarria, Bernice Guintu, Leslie Lung, & Sean Vang.

Student Group 2015b (Studio class LDA 191): Taylor Baer, William Glaeser, Carmen Godinez, Vanvisa Musigapala, Nathaniel Oakley, & Elvis Wong.

## 6 REFERENCES

- Ahern, J., Leduc, E., and York, M. L. (2006). *Biodiversity Planning and Design: Sustainable Practices*. Landscape Architecture Foundation. Covelo: Island Press.
- Airola, D. A. (1988). *Guide to the California Wildlife Habitat Relationships system*. Sacramento: Jones & Stokes Associates.
- Beck, J. L., & Suring, L. H. (2009). *Wildlife Habitat-Relationship Models: Description and Evaluation of Existing Frameworks*. In J. Millsaugh & F. R. Thompson (Eds.), *Models for Planning Wildlife Conservation in Large Landscapes* (pp. 251-285). Boston: Elsevier Academic Press.
- Bennett, A. F. (1999). *Linkages in the Landscape: the Role of Linkages and Connectivity in Wildlife Conservation*. Cambridge: IUCN.
- Burley, J. B. (1995). International greenways: a Red River Valley case study. *Landscape and Urban Planning*, 33, 195-210.
- Burley, J. B. (1989). Multi-model Habitat Suitability Index Analysis in the Red River Valley. *Landscape and Urban Planning*, 17, 261-280.
- California Department of Fish and Wildlife (CDFW) and the California Interagency Wildlife Task Group (CIWTG). (2014). CWHR Version 9.0 personal computer program. Sacramento: California Department of Fish and Wildlife. Website: <https://www.dfg.ca.gov/biogeodata/cwhr>
- Cole, D. N. (1993). Minimizing conflict between recreation and Nature Conservation. In D. S. Smith and P. C. Hellmund (Eds.), *Ecology of Greenways: Design and Function of Linear Conservation Areas* (pp. 105-122). Minneapolis: University of Minnesota Press.
- Cooperrider, A. Y. (1986). Habitat evaluation systems. In A. Y. Cooperrider, R. J. Boyd, & H. R. Stuart (Eds.), *Inventory and Monitoring of Wildlife Habitat*. Denver: U.S. Department of the Interior, Bureau of Land Management Service Center.
- Dramstad, W.E., Olson, J.D. & Forman, R.T.T. (1996). *Landscape Ecology Principles in Landscape Architecture and Land-Use Planning*. Washington D.C.: Harvard University Graduate School of Design, Island Press, and American Society of Landscape Architects.
- Fabos, J. G., & Ahern, J. (Eds.) (1995). *Greenways: The Beginning of an International Movement*. New York: Elsevier.
- Forman, R. T. T. (1995). *Land Mosaics: the ecology of landscapes and regions*. New York: Cambridge University Press.
- Forman, R. T. T., & Godron, M. (1986). *Landscape Ecology*. New York: Wiley.
- Flink, C. A. & Searns, R. M. (1993). *Greenways: A Guide to Planning, Design and Development*. The Conservation Fund. Covelo: Island Press.
- Greco, S. E., & Larsen, E. W. (2014). Ecological design of multifunctional open channels for flood control and conservation planning. *Landscape and Urban Planning*, 131, 14-26.
- Greco, S. E., Plant, R. E., & Barrett, R. H. (2002). Geographic modeling of temporal variability in habitat quality of the yellow-billed cuckoo on the Sacramento River, miles 196-219, California. In J. M. Scott, P. J. Heglund, F. Samson, J. Haufler, M. Morrison, M. Raphael, & B. Wall (Eds.), *Predicting Species Occurrences: Issues of Accuracy and Scale* (pp. 183-196). Covelo: Island Press.
- Hellmund, P. C. (1998). *Planning Trails with Wildlife in Mind: A Handbook for Trail Planners*. Denver: Trails and Wildlife Task Force and Colorado State Parks.

- Hellmund, P.C. & Smith, D.S. (2006). *Designing Greenways: Sustainable Landscapes for Nature and People*. Covelo: Island Press.
- Huber, P. R., Shilling, F. M., Thorne, J. H., & Greco, S. E. (2012). Municipal and Regional Habitat Connectivity Planning. *Landscape and Urban Planning*, 105, 15-26.
- Jennings, M. D., Csuti, B., & Scott, M. J. (1996). Wildlife Habitat Relationship Models: Distribution and Abundance. *Conservation Biology* 11(6), 1171-1172.
- Johnson, B. R., & Hill, K. (Eds.) (2002). *Ecology and Design: Frameworks for Learning*. Covelo: Island Press.
- Johnson, D. H., & O'Neil, T. A. (Managing Directors). (2001). *Wildlife-Habitat Relationships in Oregon and Washington*. Corvallis: Oregon State University Press.
- Jongman, R., & Pungetti, G. (Eds.) (2004). *Ecological Networks and Greenways: Concept, Design, and Implementation*. New York: Cambridge University Press.
- Lambeck, R. J. (1997). Focal Species: A multi-species umbrella concept for nature conservation. *Conservation Biology*, 11, 849-856.
- Lambeck, R. J. (2002). Focal Species and Restoration Ecology: Response to Lindenmayer et al. *Conservation Biology*, 16(2), 549-551.
- Lindenmayer, D. B., Manning, A. D., Smith, P. I., Possingham, H. P., Fischer, J., Oliver, I., & McCarthy, M.A. (2002). The focal-species approach and restoration: a critique. *Conservation Biology*, 16(2), 338-345.
- Mayer, K. E., & Laudenslayer, W. F., Jr. (Eds.) (1988). *A guide to the wildlife habitats of California*. Sacramento: California Department of Forestry and Fire Protection.
- Marsh, W. M. (2010). *Landscape Planning: Environmental Applications*. Fifth Edition. New York: Wiley.
- Morrison, M. L., Marcot, B. G., & Mannan, R. W. (1992). *Wildlife-habitat Relationships: Concepts and Applications*. First edition. Madison: The University of Wisconsin Press.
- Morrison, M. L., Marcot, B. G., & Mannan, R. W. (2012). *Wildlife-habitat Relationships: Concepts and Applications*. Third edition. Covelo: Island Press.
- Ndubisi, F., DeMeo, T., & Ditto N. D. (1995). Environmentally sensitive areas: a template for developing greenway corridors. *Landscape and Urban Planning*, 33, 159-177.
- Ndubisi, F. (2002). *Ecological Planning: A Historical and Comparative Synthesis*. Baltimore: Johns Hopkins University Press.
- Noon, B. R., & Dale, V. H. (2002). Broad-Scale Ecological Science and Its Application. In K. J. Gutzwiller, (Ed.), *Applying Landscape Ecology in Biological Conservation*. New York: Springer-Verlag.
- Noss, R. F. (2006). Greenways as Wildlife Corridors. In P. C. Hellmund & D. S. Smith (Eds.), *Designing Greenways: sustainable landscapes for nature and people* (pp. 70-107). Covelo: Island Press.
- Noss, R. F., O'Connell, M. A. & Murphey, D. D. (1997). *The Science of Conservation Planning: Habitat Conservation under the Endangered Species Act*. Covelo: Island Press.
- Peck, S. (1998). *Planning for Biodiversity: Issues and Examples*. Covelo: Island Press.
- Sawyer, H., Kauffman, M. J., Nielson, R. M., & Horne, J. S. (2009). Identifying and prioritizing ungulate migration routes for landscape-level conservation. *Ecological Applications*, 19(8), 2016–2025.
- Sawyer, J. O., Keeler-Wolf, T., & Evens, J. M. (2009). *A Manual of California Vegetation*. Second Edition. Sacramento: California Native Plant Society.

- Scott, J. M., Heglund, P. J., Samson, F., Haufler, J., Morrison, M., Raphael, M., & Wall, B. (Eds.). (2002). *Predicting Species Occurrences: Issues of Accuracy and Scale*. Covelo: Island Press.
- Steiner, F. (2000). *The Living Landscape: An Ecological Approach to Landscape Planning*. Second Edition. New York: McGraw Hill.
- Steinitz, C. (2002). On Teaching Ecological Principles to Designers. In B.R. Johnson & K. Hill (Eds.), *Ecology and Design: Frameworks for Learning* (pp. 231-244). Covelo: Island Press.
- Store, R., & Jokimaki, J. (2003). A GIS-based multi-scale approach to habitat suitability modeling. *Ecological Modelling*, 169(1), 1-15.
- Verboom, J., & Pouwels, R. (2004). Ecological functioning of ecological networks: A species perspective. In R. Jongman & G. Pungetti (Eds.), *Ecological Networks and Greenways: Concept, Design, and Implementation* (pp. 56-72). New York: Cambridge University Press.
- Verner, J., & Boss, A. S. (Technical Coordinators). (1980). *California wildlife and their habitats: Western Sierra Nevada*. Gen. Tech. Report PSW-37. Berkeley: Pacific Southwest Forest and Range Experiment Station, Forest Service, U.S. Department of Agriculture.
- Verner, J., Morrison, M. L., & Ralph, C. J. (Eds.) (1986). *Wildlife 2000: Modeling Habitat Relationships of Terrestrial Vertebrates*. Madison: University of Wisconsin Press.
- Woolmer, G. (2010). The GIS Challenges of Ecoregional Conservation Planning. In S. C. Trombulak & R. F. Baldwin (Eds.), *Landscape-scale Conservation Planning*, (pp. 257-280). New York: Springer.

**Bio:** Professor Steven Greco, (Ph.D., Ecology; BSLA), currently serves as Chair of the Landscape Architecture and Environmental Design Program and Vice Chair of the Department of Human Ecology at the University of California, Davis. Professor Greco teaches and conducts research in areas of: conservation planning, landscape ecology, wildlife habitat relationships, GIS, spatial analysis, suitability modeling, river geomorphology, vegetation dynamics, and climate change. Since 2009 he has served as an advisory committee member for the Yolo Habitat Conservancy which is developing a habitat conservation plan (HCP) and a natural communities conservation plan (NCCP) for Yolo County, in the Central Valley of California.





COUNCIL OF EDUCATORS  
IN LANDSCAPE ARCHITECTURE

*A CELA Conference Presentation*

**Abstract ID: 259**

## **FORMED BY WATER: CASE OF A DESERT CITY IN IRAN**

### **TEBYANIAN, NASTARAN**

Architect, Landscape Architect & Researcher, Hamer Center for Community Design, Pennsylvania State University.

### **MEMAR, MAZIAR**

Architecture & Planning Professional, School of Art & Architecture, Shiraz University

### **HENDERSON, RON**

Professor & Director of Landscape Architecture, Illinois Institute of Technology

### **ABSTRACT**

*The water division system of Semnan is one of the best surviving examples of traditional ways of managing and distributing water in Iranian Plateau. Semnan is located on the ancient Silk Road, on a narrow strip between Alborz massif and the central Kavir desert of Iran. The mountain range blocks the damp maritime air masses of Caspian Sea and causes an arid climate to its south. However, the same mountains are the main water source for the settlements. As in Semnan, water of a creek is distributed to create an oasis of about 15 square kilometers. This system is at least a millennium old and it has developed sophisticated physical and managerial mechanisms to respond to the different environmental and social needs and challenges.*

*This paper studies both the physical and cultural structures of the historical water division network in Semnan. It depicts the components of these two structures in three regional, city and neighborhood scales and shows the relation of the water network to urban form and fabric. The paper also studies the social mechanisms, the roles and rules through which the system was managed. The method of study is mixed archival and field study. We have used historical archives including a 15th century endowment document, historical census and monographic data, oldest aerial photos, as well as oral history and field study.*

### **1.1 Keywords**

Urban Form, Water Division System, Semnan, Iran

## 1 INTRODUCTION

Traditional systems of managing and distributing water have historically played a vital role in the formation and evolution of many rural and urban landscapes on the Iranian Plateau (Spooner, 1974). This is mainly because many cities have evolved within agrarian landscapes that require irrigation due to insufficient precipitation. The traditional water division system of Semnan is one of the best surviving examples of such systems.

The Semnan system has developed sophisticated physical and managerial mechanisms to respond to different environmental and social needs. Despite alterations and damages in recent decades, the system remains partially functioning since many of the needs that originally formed it still exist. As this system is at risk, its social and physical structures need to be documented and studied fully and its potentials understood for future sustainable urban planning and design. Although some valuable ethnographic research (Aḥmad'panāhī, 2002; Şafinežād, 1980) has been completed, many geographical, environmental and architectural aspects of the system have not been studied and these are first explored in this paper.

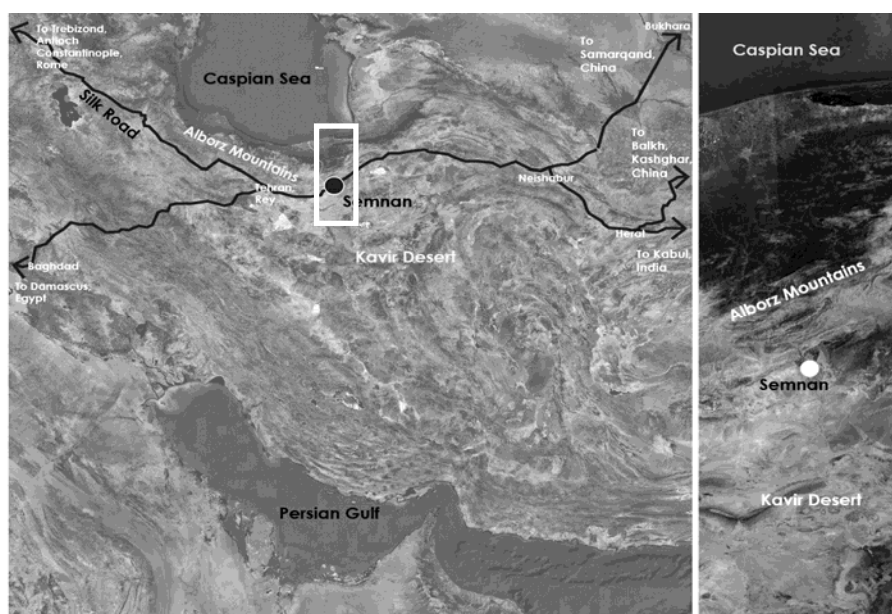
The needs and challenges that this traditional system has responded to-and its continuity through ages- reveals its potentials for the challenges we are facing today. These potentials include sustainable water management in arid climate, expanding and reinforcing decentralized but connected green infrastructure in the city, involving people in shaping urban landscapes, improving environmental justice, and designing lively public spaces. The broader research that has been conducted by the authors of this paper addresses many of these issues. However, this paper focuses on introducing the general physical and cultural aspects of Semnan's water division

network and its components in relation to the form and fabric of the city at different scales. Four scales are identified, which include: regional, city, neighborhood, and land-lot (house/farm/orchard). It also studies how this network is related to other water systems, such as qanats, and water-related architectural elements, such as watermills. To study these layers we have used archival and field study methods. We have explored the oldest aerial photos, historical archives (including a mid-15th century endowment document), the oldest census, and monographic data - as well as oral history and field study<sup>1</sup>.

## **2 THE GEOGRAPHICAL AND HISTORICAL CONTEXT**

Semnan, capital of an eponymous province, is a city with a population of about 150,000 people. It is located 220 km east of the national capital, Tehran, on the main highway to the 2<sup>nd</sup> largest city, Mashhad, in a narrow strip between the Alborz range to the north and the Great Kavir Desert of central Iran to the south (53° 24' E, 35° 34' N, 1100-1200 m above sea level). Semnan and its immediate villages rest on an alluvial fan formed by a valley cut through and draining from chains that constitute the southernmost edge of the central Alborz (Figure 1). This high range blocks the damp air masses of the Caspian Sea which produces a rain shadow to its south that causes the arid climate of Semnan (Köppen BWh) with an average annual precipitation of 140 mm (Armanshahr, 2009). However, the same snow-capped mountains are the main source of water for the settlements specifically when they need it most for agriculture in spring and summer as the insufficient rain that does fall is mostly limited to fall and winter.

Evidence of hunter-gatherer communities from Middle Paleolithic era has been found in the region (Nasab et al. 2013) and, since the early Neolithic period, several settlements appeared south of current Semnan in what was previously a more habitable area for agrarian communities. As precipitation, flow of streams, and underground water levels gradually decreased during the millennia since the last glaciation period and desertification threatened Semnan from south, these settlements moved north to the northernmost edge of alluvial plain. However, while climatic condition for survival of these small and scattered settlements was gradually deteriorating, geopolitical and technological advancements led to the flourishing of long-distance trade routes (commonly known as the Silk Road) in the first millennium BCE gave Semnan a renewed opportunity for development. Ironically, this opportunity resulted from the same geographical features threatening its existence. While the series of trade routes connecting China to the Mediterranean world usually split into several parallel routes, here, due to the elongated Caspian Sea and high Alborz range to the north, they were mostly limited to a single route on the narrow margin of an almost unnavigable desert (Figure 1).



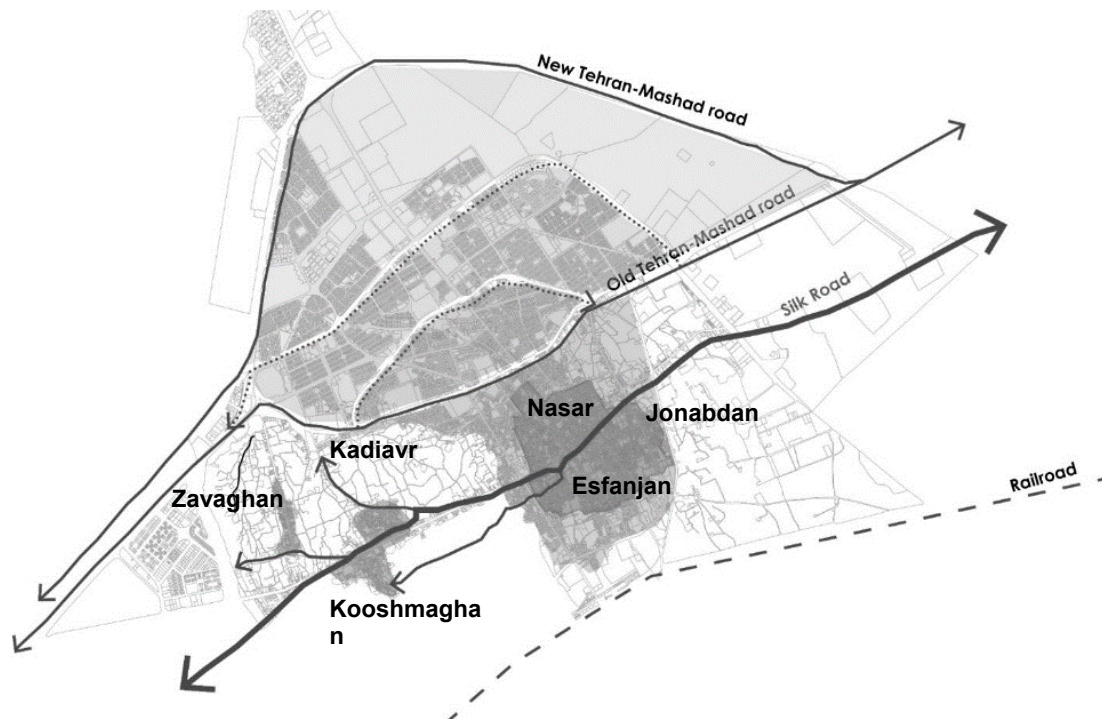
**Figure 1: Geographical context of Semnan with the ancient Silk Road depicted (by authors)**

This strategic location along the Silk Road instigated the emergence of an urban agglomeration around one of the villages (Esfanjan) soon expanding into nearby districts of Jonbadan and Nasar. These three formed the walled urban core and together with three other neighborhoods farther to the west (Zavaghan, Koushmaghan and Kadivar) constituted the city of Semnan from the middle ages until the early 20<sup>th</sup> century. The ancient Silk Road entered the walled city from the eastern Khorasan gate and passed by the old congregational mosque with its 11<sup>th</sup> century minaret where the road changed into a domed bazaar (parts of which still exist while the rest is overrun by a modern street) before exiting from the western Eraq gate and passing through the three external neighborhoods.

In the 20<sup>th</sup> century with the advent of motor vehicles, the route shifted to the northern edge of the cultivated suburb, driving modern developments to its north. As the city expanded northward, it required yet another ring-road to the north, which itself lead to further northward expansions and the same cycle repeated again. The early 20<sup>th</sup> century Tehran-Mashhad road has now become both the main commercial street of the city and the border between the old and new fabric (Figure 2). The neighborhoods formed between the old and the newest Tehran-Mashhad motorways since mid-20<sup>th</sup> century are mostly detached from the southern old fabric and lack many of its social and physical qualities.

While trade prompted a thriving urban core in the oasis, the consequent population growth coupled with the aforementioned environmental challenges required a careful management of vital water resources. Being in such an arid climate, Semnan residents devised sophisticated ways of water management. The traditional water division of Semnan is certainly more than a millennium

old. Muqaddasī, in his geographical treatise dated circa 985 AD, briefly points out to the water division system in Semnan including the creek and reservoirs<sup>ii</sup> (Muqaddasī 1994, p. 313). The oldest surviving documents that provide detailed information on the system are two major endowment scrolls: the Amid-al-Molk endowment document from circa 1465 AD (870 AH) and the *Sanad-e Ab-e Sahar*, or morning water document, from circa 1630 AD (1040 AH) (Aḥmad'panāhī, 2002; Rezaei, 2007). These documents describe details such as locations and names of qanats and reservoirs and laws related to water sharing. In the following sections, we describe different components that shape the physical and social structures of the water network in three different scales. Finally, we look at the role of the water division network on urban form and function of Semnan.



6

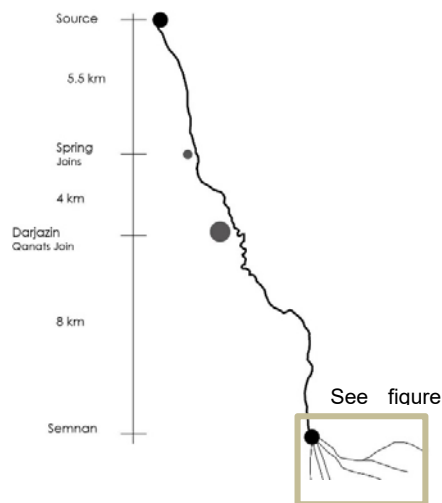
**Figure 3** The northward expansion of the city. The historical core of the city has been highlighted with darkest gray. (by authors)

### 3 PHYSICAL STRUCTURE OF WATER DIVISION SYSTEM

Water for irrigation and domestic use in Semnan was historically provided through an over-ground water distribution network dividing a creek coming from the Alborz mountain range onto the alluvial plain. The Gol-e-Roodbar creek originates from the mountains 18 km north of the city. On its way south, two qanat chains and two springs join the creek (Figure 3). The discharge of water was formerly roughly 400 liter/second until the 1980s but it has reduced to half that amount in recent years (Armanshahr, 2009). The following description of the water division network is based on its condition in mid-20th century before it went through major alterations. While the general physical structure of the division system is still more or less intact, the purpose, allocation and shares, and social structure have changed. For describing the water division network, we created a specific terminology for naming the different levels of nodes and links in the network. Nodes are called *catchments* and different levels of links are called *creek*, *flow* and *infiltration*. These terms have been used in order to focus more on natural elements rather than using the network terminology from mathematics or city planning.

The water division network consists of three main division points in regional, city and neighborhood catchments. The regional catchment is located 8 km before the creek reaches the city. Here, Havaban and Eslamabad qanats join the creek close to the village of Darjazin. For 36 hours out of each 15-days cycle, water goes to Darjazin and the rest flows to Semnan for further division (Aḥmad'panāhī, 2002; Şafinežād, 1980). The city catchment, which is the critical division point for Semnan, is called *Para* in local Semnani language (Figure 4). It means “where water is

divided” and *par* is cognate with similar words in some other Indo-European languages such as *part* in English. Here, the creek divides into five streams that goes to six reservoirs supplying corresponding neighborhoods. Para consists of cascading ponds that level and regulate the water surface and prepare it for a precise division. The border of each cascading pond is defined by a large timber called Barjom. Since Para is subject to east-west winds, small hills flank the river to work as wind barriers that maintain an even water surface. The hills are reinforced with reeds planted along the cascading ponds. Reservoirs are the *neighborhood catchments*. There, water is again divided into smaller streams that travel mostly through alleys until reaching their destinations in farms, orchards and houses (Figure 5).



**Figure 3 The Gol-e Roodbar creek from its origin to Para.**  
(by authors)



**Figure 4 Para.**  
(photos by Nastaran Tebyanian)

The streams in the network are also categorized into three types: 1. creek (before the water reaches Para), 2. flow (from Para to the reservoirs), and 3. infiltrations (from the reservoirs



to farms, orchards and houses). Each flow coming out of Para is named after the neighborhood to which it belongs (Connell, 1970). The five flows (from west to east) are Zavaghan, Koushmaghan, Kadivar, Nasar-Esfanjan and Jonabdan. The Jonbadan stream, further in its course, divides into two streams that are directed to the reservoirs of Latibar and Shahjooy neighborhoods respectively. Figures 6 to 9 show a flow, a reservoir and water division immediately after the reservoir and further along the infiltrations. The general hierarchy of the system with division points and streams can be seen in Figure 10.

Since centuries ago, the water flow of the creek was not enough to reach the villages south of Semnan. Thus, qanats were built to provide water for their residents and farms. The existence of qanats in Semnan region is reported by Greek historian Polybius from 2<sup>nd</sup> century BC (Briant, 2001). Interestingly, this is “the oldest and incontestable reference” to qanat in historical texts (de Planhol, 2011). Two qanats are described in the Amid-al-Molk document. According to the scroll, these qanats were constructed by Amid-al-Molk himself to serve the public interest. In figure 10 the qanats are illustrated based on historical and current aerial photos and Amid-al-Molk description of their locations.



**Figure 5** Aerial photo of 1956 showing the water network. The parcels along the streams before they reach reservoirs are the gardens attached to watermills. (Source: *National Cartographic Center of Iran, scanned and assembled by authors*)



**Figure 6 (left) The flow from Para to Latibar reservoir along a street**

**Figure 7 (right) Kadivar reservoir**

**(photos by Maziar Memar)**



**Figure 8 (above)**

The water division point immediately downstream from Kadivar reservoir with several barjoms marking the start of infiltrations irrigating orchards of Kadivar. Two men are changing the course of water. The bridges made over the streams are for bringing water from the westernmost stream (left) to eastern ones. This is a result of changes in water sources and addition of water from wells in recent decades to the old system.

**(photo by Maziar Memar)**



**Figure 9 (above) a division point downstream from Kadivar reservoir. There are many of such smaller infiltrations dividing into two or three, before they reach the orchards and farms.**

**(photo by Maziar Memar)**

The physical structure of the water division system is not limited to the reservoirs and streams. Several architectural elements were directly related to water, namely watermills, *yakhchals* (ice-pits), public baths, and cisterns (Connell, 1970). From the 17 watermills once located along all the six streams flowing immediately downstream from Para, few have survived. The three flows leading to Zavaghan, Kushmaghan and Kadivar each had one watermill. Six were located along the flow to Nasar-Esfanjan reservoir and seven on the Jonabdan flow. Each watermill typically had a small garden (roughly half hectare) attached to it

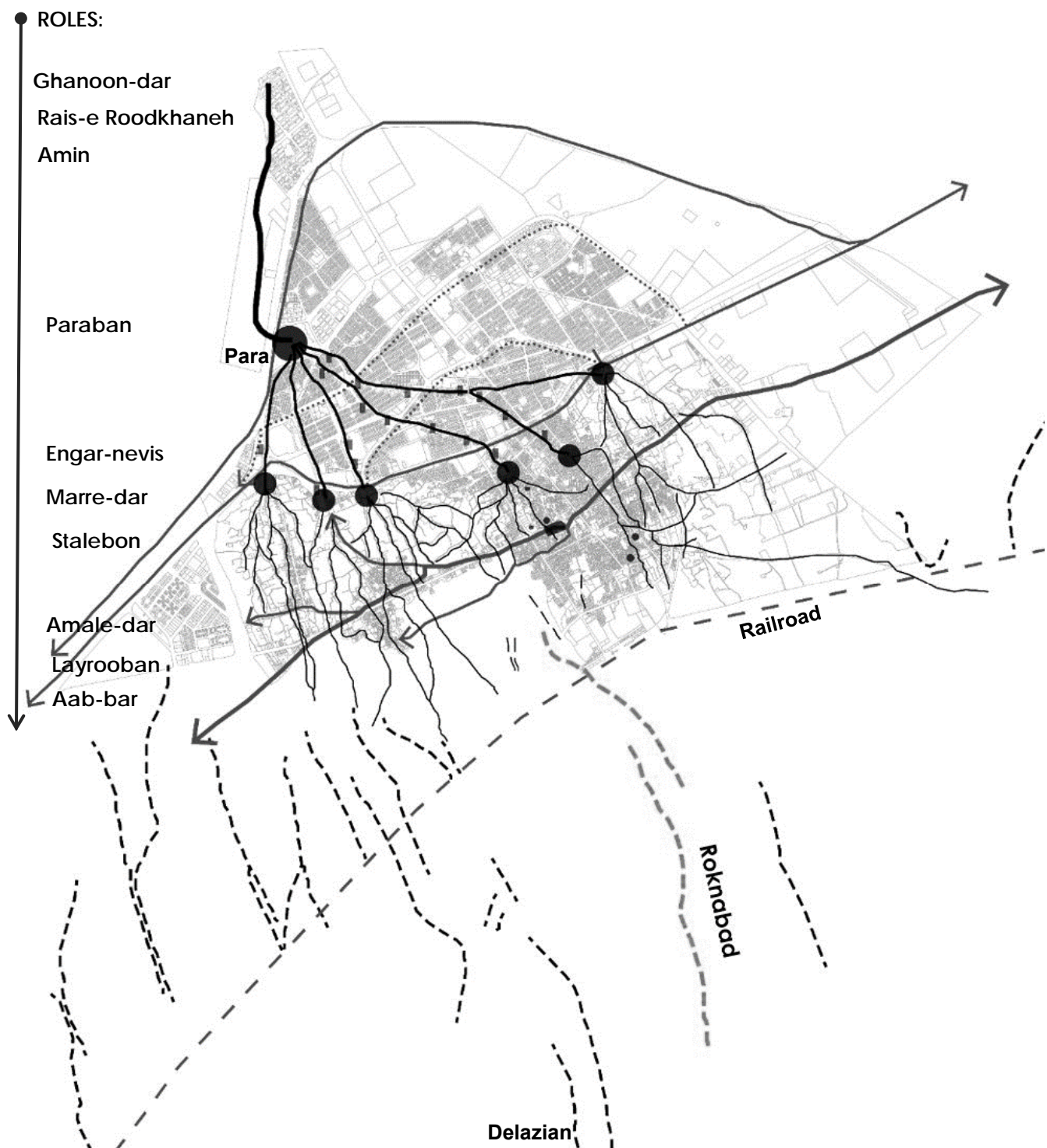


Figure 10 Water Network with qanats and watermills. The solid black lines show the streams of the water network and the circles shows the division points. The black dashed lines are the qanats that are drawn based on the historical and contemporary aerial photos. The gray dashed lines are the qanats that are described in Amid-al-Molk endowment scroll like Roknabad. The small dark gray rectangles along the streams coming from para and before they reach the reservoirs show the historical location of the watermills. The figure also shows the hierarchy of the roles in different geographical scales and locations (by authors)

## 4 SOCIAL AND MANAGERIAL STRUCTURE OF WATER DIVISION SYSTEM

The traditional water management system was a set of comprehensive roles and rules that responded to different social and environmental needs of the city residents throughout time.

### 4.1 Roles

The physical structure of Semnan's water network has three different levels of catchment with corresponding social structure roles that have been assigned at regional, city and neighborhood scales. As the creek flows downstream and branches, the number of individuals involved in the roles increases. Figure 10 shows the hierarchy of the roles in different scales.

At the top of the hierarchy was *ghanoon-dar*, or law-holder, an elected person that had access to “the book of water” including all the rules and documents on water shares at all division points. At the regional level, there were two roles: 1. *Ra’ees-e roodkhaneh*, or river chief: a person elected from Semnan to supervise the creek from its origin to Para, 2. *Amin*, or trustee: a person from Semnan who is present in Havaban (the qanat in Darjazin) to supervise the amount of water that joins from the qanat to the Gol-e Roodbar creek, and 3. *Motavalli*, or custodians: people responsible for the accurate execution of water endowments rules. At the city level, there was one main role: *paraban*, the Para-keeper, a person in charge of Para, the main division point for the entire city (Aḥmad’panāhī, 2002; Şafinežād, 1980).

At the neighborhood level, there were several roles: 1. *Engar-nevis*, or recorders: the individuals in each neighborhood that relate the *ghanoon-dar* to the owners of water shares. Each afternoon, the *engar-nevis* would write the water share of each receiver in a document called

*marre* and pass it to *marre-dar*, the keeper of these documents, 2. *Estalabon*, or reservoir-keeper: the individuals in charge of opening and closing each reservoir exit and managing tasks related to the reservoir, and 3. *Marre-dar*, or turn-keeper: the mediators between *engar-nevis* and *estalabon*. Each morning, *marre-dar* brings the *marre* written by *engar-nevis* to the reservoir, so the *estalabon* can execute the rules exactly based on the written documents (Aḥmad'panāhī, 2002; Şafinežād, 1980).

Downstream from the reservoirs, the roles involved more people. These roles included: 1) *Amale-dar* (operatives also called *moqassem*), or dividers: people in charge of smaller water divisions in the areas downstream from each reservoir, 2. *Layrooban*, or dredge-men: people in charge of the maintenance and dredging of the streams, and 3. *Aab-bar*, water takers: owners of water shares (Aḥmad'panāhī, 2002). All these roles are summarized and categorized in the regional, city, neighborhood and sub-neighborhood levels in table 1.

**Table 1: Roles in four different scales**

Regional Level	Ghanoondar (law-holder)
	Ra'ees-e- Roodkhaneh (River Chief)
	Amin (Trustee)
City Level	Paraban (Para keeper)
	Motavalli (Custodian)
Neighborhood Level	Engar-nevis (Recorder)
	Estalebon (Reservoir Keeper)
	Marre-dar (Turn keeper)
Sub-neighborhood / Parcel Level	Amale-Dar (Operative, also called divider)
	Layrooban (The Dredge Man)
	Aab Bar (consumer)

## 4.2 Rules

The water division had a cycle of 15 days. Each cycle was called *darajan*. In 13 of 15 days in each cycle, water would flow to the entire city - including *Mahallat-e-salas*, the three western neighborhoods of Kadivar, Kooshmaghan and Zavaghan. 36 hours was dedicated to Darjazin and 12 hours to Mahallat-e-salas alone. The system was based on a typical total discharge measured as 32 *pey* or 850 *esse*. Each *pey* is equal to 27 cubic centimeters. The traditional proportion of

water share between the neighborhoods was: Shahjooy (5) Latibar (5), Nasar-Esfanjan (8) Kadivar (5) Kooshmaghan (4), Zavaghan (5) (Aḥmad'panāhī, 2002). The amount of water mentioned in the Amid-al-Molk scroll is 31 *pey* and is divided just slightly differently<sup>iii</sup> from the early-twentieth century version (Rezaei, 2007).

There were several special water shares to adjust the water division system to different environmental and social needs. Among the environmental adjustments, we can point out to *fazel-e-miah*, or extra waters, and *ab-e tabestaneh*, or summer water. *Fazel-e-miah* is the water dedicated to the three western neighborhoods in 12 hours out of each 15 days cycle. This was due to the large concentration of gardens and farms in these neighborhoods. The *ab-e tabestaneh* was dedicated to Jonbadan. One day in each of the 7 summer cycles (from June 5<sup>th</sup> to September 22<sup>nd</sup>) belonged to this neighborhood. This was because Jonbadan was located in the southeast where it was more exposed to sun and thus required more water. *Nesfe-i va chahar-yek*, or half and quarter, was a specific rule for the lots with a small share of water and far from the reservoirs. Based on this rule, these lots received their water at twice the assigned amount but in half the regular time in order to avoid infiltration of their small share in the long distance from the reservoirs to the lots (Şafinežād, 1980, p. 105-120)

Among the social adjustments in the water division system, we can mention *ab-e-sahar*, or morning water, and *ab-e-rooz*, or day water. Nasar and Esfanjan were the neighborhoods where the most important and water-consuming public buildings such as mosques, public cisterns, and baths were located. To compensate this extra usage of water and to make sure that all people

can have access to water for drinking, sanitation, and religious rituals, *ab-e-sahar* water share was dedicated to these neighborhoods. The Nasar and Esfanjan common reservoir was opened each morning before sunrise for the time it takes for water to reach and exit the southern edge of Semnan. In these 15-20 minutes, the water filled the public cisterns and baths. The person in charge of supervising this process was called *saharban*. *Ab-e-sahm-sahmi* was a variation of *ab-e-sahar* in the morning of the first day of year in Persian calendar (March 21<sup>st</sup>) when the reservoir was open for more than 3 hours and people could use it as much as they wanted. Another example of social management of water shares is *ab-e-rooz*. This water share was assigned for emergency situations like the aftermath of a natural disaster or political conflict. In these situations water came 14 instead of 13 days to Semnan with the difference sold and the revenue from it was dedicated to help the citizens affected by the emergency situation (Aḥmad'panāhī, 2002). The aforementioned types of water share are not exclusive and there were several other instances of such adjustments. Some of these water shares were time-based and were in effect during a particular period of the year. Table 2 summarizes these water shares according to the type of intended adjustment.



**Table 2: Social and environmental adjustments to the water division network**

Adjustment type	Special water share	Explanation
Environmental Adjustment	<i>Fazel-e-miah</i> (extra water)	The special water goes to specific neighborhoods to compensate lack of water due to concentration of farms and gardens here.
	<i>ab-e tabestaneh</i> (summer water)	The special water goes to specific neighborhoods in summer to compensate shortage of water due to more exposure to sunlight.
	<i>Nesfe-i va chahar-yek</i> (half and quarter)	Specific rule that decreased the infiltration of small water share of the lots that were far from the reservoirs.
Social Adjustment	<i>ab-e-sahar</i> (morning water)	The extra water dedicated to fill the public cisterns and baths in the most crowded and socially central neighborhoods.
	<i>ab-e-sahm-sahmi</i> (shared water)	A variation of <i>ab-e-sahar</i> to celebrate the first day of year.
	<i>ab-e-rooz</i> (day water)	Revenue from an extra water share used for managing emergency situations.

## 2 5 WATER DIVISION SYSTEM AND URBAN FORM AND FUNCTION

Semnan is a city created by the two main forces of a trade route and water. These forces can still be traced in the layout of many streets and alleys. While the main southern east-west street runs along the same course as the ancient Silk Road, the north-south streets are mainly formed along the streams of the water division network. This is easily recognizable in the larger streets

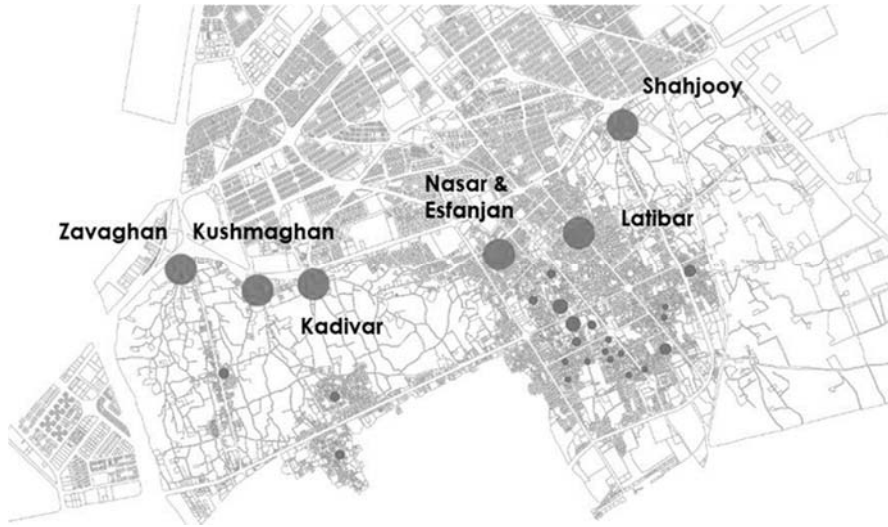
that are congruous with the streams coming from Para to the reservoirs. The smaller alleys in the south, particularly in the cultivated areas, still have the small streams visible in the middle.

Traditionally, the main public space for each neighborhood was *tekia*. The *tekia* were open, semi-open or closed public spaces located mostly on the intersection of the alleys and were mostly used for religious ceremonies other than daily prayers done in mosques (Figure 11). Regularly, these public spaces were places of social interaction and constituted an essential part of the identity of each neighborhood. Neighborhoods had one or more *tekia* based on their size and importance. In Semnan, another important public space contributing to each neighborhood's identity was the reservoir. Figure 12 illustrates these two types of public spaces for each historical neighborhood. In the past, as a way of general announcement, the *estalebou* used to close the water exit of a reservoir, so everybody in the neighborhood would come for an inquiry to the reservoir and the officials would announce an important issue after people gathered. Another example of the interesting dialogue between the *tekia* and the reservoirs is the relationship of these spaces with the roles in the water management system. Each afternoon, when water shareholders gathered in a corresponding *tekia*, the *engar-nevis* would write the assigned shares in *marre* and pass it to *marre-dar*. The next morning, the *marre-dar* went to the reservoirs where the water shareholders were waiting for him to supervise the execution of the water share rules.



Figure 11 The first two photos from left show two permanently covered Tekia. Most fixed roofs are added in recent decades. Historically the *tekia* were covered temporarily for rituals as seen in the third photo and aerial photo of 1956.

The tracing of this social flow in the urban fabric and exploring its role in defining and connecting the public spaces of the city is missing from the historical urban research in many cases. Although there are several studies on the architectural public spaces and urban form in Iran, the roles of natural elements in the formation of public spaces and their associated social dynamics are less explored.



**Figure 12** The reservoirs and Tekia in the historical neighborhoods. The locations of the tekia are drawn based on the field study and contemporary and historical aerial photos. (by authors)

Another important aspect of the water division system in relation to the urban form and its geographical context can be seen in the adjustments made to the division system to improve environmental justice in the city. Although it seems obvious that greater access to more water should be delivered to where people need more water, there are many cases in the modern era that distribution is not fair and does not consider the nuances in the environmental settings. With soil that is more fertile west of the city, a larger water share was directed there to support the larger area of fertile gardens. Stronger exposure to sun and evapotranspiration for eastern

19

neighborhoods also resulted in an extra seasonal water share. A similar arrangement was made for the dense central neighborhoods with more public amenities. Such common-sense adjustments is mostly missing from the top-down modern regulations and approaches to the distribution of resources. The bottom-up self-organizing nature of the traditional water division system allowed finding solutions by the cooperation of the owners of the problem (Farhadi, 2009).

## 6 CONCLUDING REMARKS

For centuries, the traditional water division system of Semnan has irrigated and grown an oasis amid a harsh environment. It has provided generations of its residents with a participatory and sustainable model of managing common resources. The water division system of Semnan is evidence of a counterpoint to Wittfogel's *hydraulic despotism*, a theory that large scale water management regimes were centrally controlled and tended toward despotism (Wittfogel, 1981). In a city, that in many ways fulfills Wittfogel's criteria, where everything is dependent upon a single source of water, not only have neither a monopoly nor *oriental* despotism emerged, but we see one of best examples of bottom-up governing of public resources in the orient. Such examples in many cases are not recognized even in seminal works regarding agriculture and irrigation in Iran and has led to incorrect conclusions that "the peasants... are unpracticed in the art of co-operation; there is no evidence which suggests that they would be able in the immediate future to run any co-operative undertaking successfully" (Lambton, 1991, p. 396).

Semnan is a significant comparison in several aspects of similar systems on the Iranian plateau and possibly other ancient civilizations. The historical documents which describe it have

survived while many others have not. It was functioning until the modern era when it is now possible to document its physical and social structure. A comparison with that of Isfahan, the best known historical water division system in Iran (from 1545 AD), reveals more of its significance. In the water division system of Isfahan, which is much larger in area than that of Semnan, the system regulates water on a yearly basis (only 165 days of the year) and in a regional scale where the basin of the river is divided into three districts; upstream, central and downstream. However, in Isfahan, the more fertile downstream districts get half the days of the upstream and receives no water for several months causing “up to 70 percent of the soil remaining fallow every year” (de Planhol, 2006). In comparison to Semnan, the water division system of Isfahan, to some extents, institutionalizes the injustice that occurs in the absence of a regulating system, where downstream receives less water.

The water division system has gone through major alterations in the city’s transition to modern water resources and governmental water management in the last 50 years. Despite these changes, the main components of its physical structure (including the reservoirs and parts of the streams) are still used for agricultural purposes. The social structure is also partially practiced among the farmers in the agricultural lands. The destruction process, though, is rapid and the potentials of the system are frequently overlooked in recent and current city planning. The intertwined social and environmental layers of the water division system have always influenced the urban form and social dynamics in the city and still provide untapped potentials for contemporary resilient urban design.

## ENDNOTES

---

<sup>i</sup> Most of the field studies were done between 2010-2013 by Nastaran Tebyanian and Maziar Memar.

<sup>ii</sup> Collins translates the text as “Simnān is on the main road; here is a fine mosque situated in the market; water flows through the market, and tanks in turn are filled from it. Its population has decreased.” However in the original Arabic text -which has been the source for this translation- the pronoun in “flows through it” most probably refers to Simnān not the market and the word howz definitely refers to open reservoirs similar to present ones. The last sentence only says “it has decreased” and it might refer to water not the population as Collins has deduced.

<sup>iii</sup> Jonabdan (10), Nasar-Esfanjan (8) Kadiavr (6) Kooshmaghan (3.25), Zavaghan (3.75). Note that Jonbadan includes both Latobar and Shahjooy. Therefore, the only difference is in the share of the three western neighborhoods.

## REFERENCES

Aḥmad'panāhī, M. (2002). *Shīvah-i sunnatī-i taqīm-i āb dar Simnān*. Tīhrān: Samīrā.

Armanshahr.Mohandesin-i Moshaver (2009), Tarhe-i Omran va hoze nofuz-i (jame) shahr-i Semnan.  
Semnan: Sazman-i maskan va shahrsazi ostane Semnan.

Briant, P. (Ed.). (2001). Polybe X.28 et les qanats: Le témoignage et ses limites. In Irrigation et drainage dans l'antiquité, qanāts et canalisations souterraines en Iran, en Egypte et en Grèce: Séminaire tenu au collège de France. (p. 15-40). Paris: Thotm éditions.

Farhadi, Morteza (2009), Farhange Yarigari dar Iran, [The Tradition of Cooperation in Iran: An introduction to anthropology and sociology of cooperation], Tehran: Markaze Nashre Daneshgai.

Connell, J. (1970). Semnan: Persian city and region. London: University College, L. Dept. of Geography.

de Planhol, X. (2006) ISFAHAN i. GEOGRAPHY. Encyclopedia Iranica. Retrieved from

<http://www.iranicaonline.org/articles/isfahan-i-geography#2>

de Planhol, X. (2011). KĀRIZ iv. Origin and Dissemination. Encyclopedia Iranica. Retrieved from

[http://www.iranicaonline.org/articles/kariz\\_4](http://www.iranicaonline.org/articles/kariz_4)

- 
- Lambton, A. K. S. (1991). *Landlord and peasant in Persia: a study of land tenure and land revenue administration*. London ; New York : New York, NY: I.B. Tauris ; Distributed by St. Martin Press.
- Muqaddasī, M. ibn A., & Collins, B. A. (1994). *The best divisions for knowledge of the regions: a translation of Ahsan al-taqasim fī maʿrifat al-aqalim* (1st ed). Reading, UK: Centre for Muslim Contribution to Civilization : Garnet Pub.
- Nasab, H. V., Clark, G. A., & Torkamandi, S. (2013). Late Pleistocene dispersal corridors across the Iranian Plateau: A case study from Mirak, a Middle Paleolithic site on the northern edge of the Iranian Central desert (Dasht-e Kavir). *Quaternary International*, 300, 267–281.  
<http://doi.org/10.1016/j.quaint.2012.11.028>
- Rezaei, Omid. (2007). *Barrasi va motale'e tatbiqu-i vaqfie qazi Roknoddin Amidolmolk Semnani ba vaqfnamaha-i chand hezar saleh* [A comparative study of the endowment document of judge Roknoddin Amidolmolk Semnani with other millennia-old endowment documents]. Tehran: *vaqf miras-i Javedan*, 59, 66-101.
- Şafinežād, J. (1980). *Nezamhaye abyari sonati dar Iran*. Tehran: Moassese-i tahghighat-i olum-i ejtemai.
- Spooner, B.. (1974). City and River in Iran: Urbanization and Irrigation of the Iranian Plateau. *Iranian Studies*, 7(3/4), 681–713. Retrieved from <http://www.jstor.org/stable/4310182>
- Wittfogel, K. A. (1981). *Oriental despotism: a comparative study of total power* (1st Vintage Books ed). New York: Vintage Books.

---

**Nastaran Tebyanian** is an architect, landscape architect and design researcher. She holds a Bachelor in Architecture, Master's in Landscape Architecture from Iran, and currently is a Master of Science in Landscape Architecture candidate and a researcher at Hamer Center for Community Design at Pennsylvania State University.

**Maziar Memar** is an architect and researcher. He holds a Master's in Architecture from Art University of Iran. He researches history of architecture and urbanism in Iran and has documented and studied many less explored cases of vernacular architecture and landscape in Iran. He has taught courses in design, Islamic architecture and history of Iranian cities at Shiraz University from 2008 to 2013.

**Ron Henderson** is founder of L+A Landscape Architecture and Fellow of the American Society of Landscape Architects. He is also Professor of Landscape Architecture and director of landscape architecture program at Illinois Institute of Technology and former Professor of Landscape Architecture at Pennsylvania State University.





COUNCIL OF EDUCATORS  
IN LANDSCAPE ARCHITECTURE

*A CELA Conference Presentation*

*Abstract ID: 270*

## **OF MUDDY WATERS AND PRESIDENTIAL MEMORIALS EROSION AND SEDIMENTATION IN THE POTOMAC RIVER WATERSHED**

**KELSCH, PAUL**

Associate Professor, Virginia Polytechnic Institute and State University, Washington Alexandria  
Architecture Center

### **ABSTRACT**

*This paper tells a history of erosion and sedimentation in the nineteenth century in the Potomac River basin and Washington DC. It describes deforestation and erosion due to settlement in the Shenandoah Valley, the largest area of cleared land in the watershed, and it chronicles the resultant build-up of sediment downstream in Washington, impacting navigation and commerce in the capital. George Perkins Marsh's "Man and Nature" (1864) identified these conditions as part of a long, historical pattern of human impact on the environment, and it galvanized the public, leading to well documented conservation of forestlands. Less documented is the response to the sediment that built up in many cities and ports downstream.*

*This paper specifically chronicles iron production in the Shenandoah Valley, a major source of erosion, and the accumulation of sediment in Washington as evidenced in engineers' reports and historical maps. It then discusses responses to these conditions. Upstream this included reforestation through the creation of the George Washington National Forest in 1912 on mountainous terrain surrounding the Shenandoah Valley. Reforestation was not simply a matter of natural succession but was a result of conscious management by the U.S. Forest Service and the Civilian Conservation Corps (1910s -1930s). Downstream in Washington, efforts focused on what to do with the sediment, which led to new land formation in the late 19<sup>th</sup> Century and an expanded National Mall planned by the McMillan Commission in 1902. The McMillan Commission Plan is known for its baroque axes and neo-classical monuments, and often overlooked is a forested island in the river, a foil to the baroque formality of the mall and the eventual site of the Theodore Roosevelt Memorial (1932). The island was reforested in the 1930s according to a plan by Frederick Law Olmsted, Jr., to make a small natural respite in the heart of the capital as a memorial to the president best known for his conservation agenda and wilderness exploration.*

*In order to link the efforts upstream and in the capital, this history is broad in scope but focuses on specific landscapes that illustrate two major themes. One is the positive impact of human agency in countering an environmental problem, an agency that Marsh himself assumed but often has been overlooked in later environmental rhetoric. The other is the consecration of these forests as presidential memorials, symbols of the nation that reflect the often-ambiguous relationships we Americans have with nature.*

---

The authors are solely responsible for the content of this technical presentation. The technical presentation does not necessarily reflect the official position of the Council of Educators in Landscape Architecture (CELA), and its printing and distribution does not constitute an endorsement of views which may be expressed. Technical presentations are not subject to the formal peer review process by CELA Track Chair System; therefore, they are not to be presented as peer-reviewed publications. Citation of this work should state that it is from a CELA conference paper. EXAMPLE: Author's Last Name, Initials. 2014. Title of Presentation. CELA Paper No. 14-xxxx. Baltimore, Maryland: CELA. For information about securing permission to reprint or reproduce a technical presentation, please contact CELA at [dsolco@uta.edu](mailto:dsolco@uta.edu) or 817-272-2321.

## 1.1 Keywords

Forest history, erosion, sedimentation, Potomac River, Theodore Roosevelt Memorial, Lyndon Johnson Memorial, George Washington National Forest.

## 1 INTRODUCTION

Three months after suddenly becoming president in the wake of William McKinley's assassination, Theodore Roosevelt submitted a proposal to Congress for a new national forest in the southern Appalachian Mountains.<sup>1</sup> There were no federal lands in the east that he could simply designate as a forest reserve, so he sought Congressional approval to purchase privately owned lands and create the first eastern national forest. Just two weeks earlier in his first Annual Message to Congress, the equivalent of today's State of the Union address, he had outlined a bold new conservation agenda, and this forest proposal was among his first tangible steps toward implementing it.<sup>2</sup> Creating a national forest would protect the Appalachian forests from destructive logging, and equally important, would prevent severe erosion of the steep mountainsides and damage to the rivers downstream due to excessive sedimentation.

A month after submitting that proposal, the President and First Lady Edith Roosevelt made their way across the White House lawn to the newly-built Corcoran Museum and reviewed the Senate Park Commission's proposal for "The Improvement of the Park System of the District of Columbia," more commonly known as the McMillan Commission Plan.<sup>3</sup> The plan established a new vision for the various parks and landscapes of the capital, but its highlight was a bold design for the National Mall extending well beyond the Washington Monument to the newly reconfigured shoreline of the river. This new larger mall would include land that had recently been created by dredging the main channel of the river and filling in mudflats that had formed in

---

<sup>1</sup> National Forest proposal

<sup>2</sup> First annual Message

<sup>3</sup> Biography & Senate Park Commission

the broad shallows at the foot of the Washington Monument. According to the plan, the mall would culminate at its western end in a classical memorial to Abraham Lincoln with a site for a second memorial across the new Tidal Basin that would become the Jefferson Memorial. Both these sites had been under water when Pierre L'Enfant first laid out the streets and avenues of the capital city.

These two seemingly unrelated events early in Roosevelt's presidency are tied to one another at a sedimentary level, literally. Each can be seen as a response to a heavy build-up of sediment in the Potomac River over the course of the nineteenth century. The two events, as well as the sediment itself, would come to influence the design and ecology of a future memorial to Roosevelt himself, a forested island in the Potomac. The island is wild in character today and stands in notable contrast to its classically inspired brethren on the National Mall. The Senate Park Commissioners did not envision the island as a site for a presidential memorial, but they did envision it as one of a pair of natural forested islands in the river, a foil to the formal geometry of the Mall. Notably, each of these islands was formed in whole or in part by sediment building up in the river. Further upstream, many of the mountains in the headwaters of the river would come to be preserved as part of the George Washington National Forest, an outcome of Roosevelt's proposal for an eastern national forest. This paper examines the history of deforestation, erosion and sedimentation in the Potomac River basin, to understand better the environmental context that that led to the creation of the Theodore Roosevelt Memorial and the George Washington National Forest, each a forest deemed worthy of honoring a former president of the nation.

So where did all the sediment come from? The obvious answer is farther upstream in the watershed, but the simplicity of that answer masks the interesting complexities of the watershed

and its history of settlement that led to substantial erosion. The Potomac is not a particularly large river, but in the three hundred miles upstream from Washington, it flows from its source at Fairfax Stone, West Virginia through all the major geologic provinces of the Appalachian region. As a result, its watershed is surprisingly complex. As early colonists settled in this diverse territory, they cleared the forests, even on mountainous terrain, and much of the soil on that land eroded into the region's rivers and streams eventually flowing downstream and settling as mudflats in the heart of the capital.

Much of the capital's sediment probably eroded from the rolling lands immediately upriver in the piedmont district of Maryland and Virginia because there were fewer places where it could settle out before it reached Washington.<sup>4</sup> However, the greatest amount of cleared land in the watershed was farther upstream in the Shenandoah Valley of Virginia and its less famous counterpart, the Cumberland Valley of Pennsylvania and Maryland. Being more renowned, the Shenandoah has attracted more attention from historians and offers more clues to the past sources of erosion.

The Shenandoah Valley had a robust and diversified economy that developed during the eighteenth and nineteenth centuries and focused on wheat production. With fertile limestone soils and with rivers and railroads linking it to Washington and other mid-Atlantic cities, the valley earned its Civil War era moniker "The Breadbasket of the Confederacy." Clearing the extensive forests for farmland and the steep stream banks for mill sites would have led to extensive soil loss across much of the terrain, but it was rarely documented because erosion rarely attracts much attention unless it is severe and leads to mudslides, sink holes, and the other dramatic loss of soil.

---

<sup>4</sup> Chapman... p.?

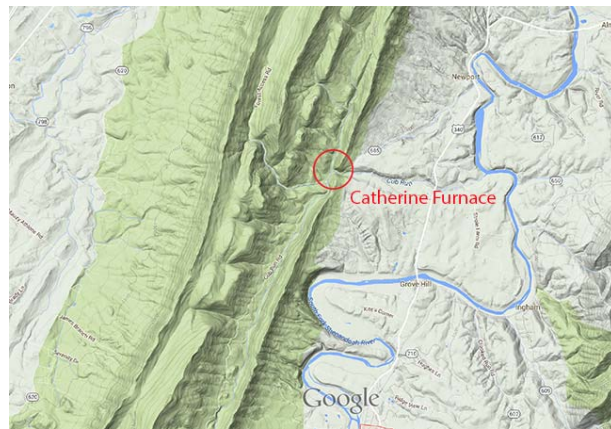
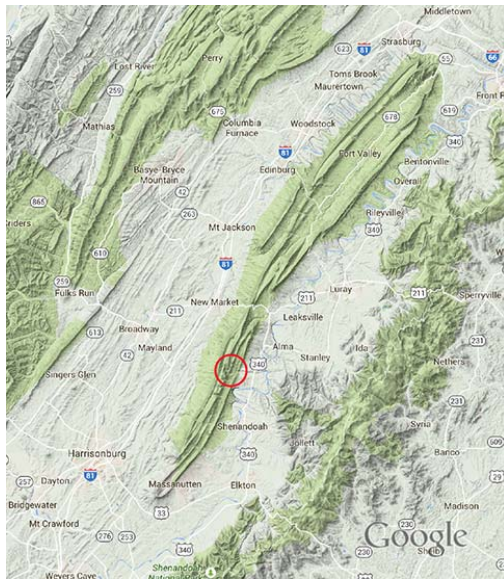
More notable at the time was the erosion of mountainsides, which were logged for timber, fuel wood, and especially for iron mining and charcoal production.

In addition to wheat, the Shenandoah Valley was an important iron-producing region through the early decades of the nineteenth century and again during the Civil War. Iron production was less widespread than farming, but it devastated the forests and mountainsides surrounding the numerous iron furnaces, and this led to serious and remarkable erosion. The combination of heavy impacts to the forests, steep mountains, and steady flowing streams in narrow valleys was a recipe for substantial loss of soil.

Iron making required several key resources: iron ore, limestone, a steady flow of water, and extensive forests to make charcoal. The most critical resource, of course, was iron ore. The Shenandoah Valley is defined by a series of long parallel ridges, waves of folded bedrock with alternating layers of different rock types tilted by geologic forces where different strata meet the surface at different elevations. At various locations in the mountains, layers of iron ore were at or near the surface, and these were the quest of iron speculators.

A well-documented example is Catherine Furnace on Cub Run in the Massanutten range, a set of fifty-mile long, parallel ridges that rise up in the center of the valley and split the Shenandoah River into its North and South Forks. At its southern end, Massanutten is a set of five parallel ridges, named rather prosaically First, Second, Third, Fourth and Fifth Mountains with Third Mountain being the highest and the backbone of the range. Although the ridges run parallel to one another, Cub Run weaves the valleys between First, Second and Third Mountains into a collective watershed on the eastern side before emerging from a small gap in First Mountain and flowing into the South Fork of the Shenandoah. [See map.] Catherine Furnace was

located right in that gap, where Cub Run draws all the resources for iron production down to the bottom of its funnel-like watershed.



At most iron plantations, the furnace was the heart of the whole operation, located adjacent to a stream that powered the bellows to stoke the fire. Furnaces were tall stone structures tapering from about ten feet at the base to about eight feet wide and thirty feet high at the top. They were often built adjacent to a steep slope, so men could more easily load the iron-laden rock into the top, sometimes crossing a small bridge to access it. The ore was usually about thirty-five to fifty percent iron, and the furnace heated it to a temperature high enough to melt the iron and let it run out into sand molds where it could cool into crude bars called ‘pigs’. Limestone was fired with the ore, because in the extreme heat it reacted with sulfur and other contaminants in the ore and thereby purified the iron.



The heat source was charcoal. Compared to coal, which was being used in England, charcoal made a more malleable iron with fewer impurities, and this made it more easily worked by local blacksmiths so it fit well within the decentralized rural economy of the Shenandoah Valley. (Williams) But making charcoal devastated the forested mountains; many thousands of acres of forest were needed to create enough charcoal to support a single furnace.

The secret to making charcoal was to control the fire so that it charred the wood without actually burning it up. The skill of the charcoal maker, or collier, was in stacking wood into a tight mass and limiting the supply of oxygen. Too much oxygen would make a “live” fire and consume the wood but too little would put it out entirely. To prepare a charcoal hearth for lighting, colliers packed four-foot logs vertically in three tiers to make a broad shallow dome of nearly solid wood. The whole structure, except for a narrow central chimney, was covered with dirt and leaves to prevent air from infiltrating this mass of wood. The colliers filled the chimney from the top with dry kindling and set it afire by adding live coals from that night’s cooking fire. Over the next two weeks, two colliers tended it continuously to control the burn, gradually

harvesting charcoal from the edges, being careful not to let too much air in and ignite the remainder of the pile. After it cooled, the charcoal could be used to fire the furnace.

Making charcoal required green wood so it wouldn't too burn too quickly, and although some trees made better charcoal than others, colliers and iron masters were not picky. Woodchoppers cut every living tree in tracts of up to 1000 acres, leaving only deadwood, brush, and trees too small to harvest. It took twenty to twenty-five years for the forest to regenerate and be ready to be cut again, and therefore about 20,000 acres of forest were needed to support a single iron furnace.

Although mining the ore took a heavy toll on the mountainsides, making charcoal destroyed far more of the forests and their soils. Fires were especially destructive, sweeping the mountainsides in the wake of clearing, sometimes escaping from the charcoal hearth itself. With just dead wood and brush remaining, fires spread rapidly, destroying whatever was left of the forest and stifling its ability to regenerate. The effect of all this mining, cutting and fire devastated the land. "The mountains were criss-crossed with roads, covered with test-pits and mining operations. Repeatedly wildfires occurred from the charcoal operations, repeatedly burning the young forest. The roads were left to erode and wash away. Conservation was unheard of at that time. Even before the decline of the charcoal iron industry [after the Civil War], a growing population was making demands on the timber, water, and wildlife resources of the forest. By the early 1900s, the forest was in poor condition from overuse and misuse." (Pigs of Iron, 13-14)

Catherine Furnace was developed in 1837 at the height of iron production in the valley, but shut down in the 1850s along with many of the other furnaces because the lack of good rail connections to bigger markets crippled production. The outbreak of the Civil War provided a new market, and Joseph Anderson of Tredaker Ironworks in Richmond encouraged all the furnaces to



go back into production to supply the Confederacy with iron for rails, cannons, and other wartime needs. By the late 1870s, the furnace was closed again when Jedediah Hopkins, an engineer from the Board of Immigration, surveyed the whole plantation to assess its viability as a place to direct new residents. “The location of the furnace,” he wrote, “is an excellent one in reference to raw materials, for iron ore, limestone, and charcoal can all come to it by gravity; the outcrops of the ore and limestone begin within a hundred yards of the furnace mouth, and a dozen square miles of the forest lands of tract “A” are readily accessible, largely by roads already constructed through the numerous parallel and transverse valleys that have their natural outlet by way of this furnace. ... The timber resources of this tract are ample to supply perpetually a large charcoal furnace and forges.”<sup>5</sup>

Since Hopkins surveyed the land forty years after it had first begun operations, it is surprising that his assessment of the forest seems so positive. Perhaps its intermittent history had allowed forests to recover enough to resist fires, or that he was trying to make a good case for reopening it. In any case, a second survey by foresters in 1912, more than three decades later, described very different conditions. According to their report, the forests were devastated, erosion was rampant, and the land seemed to be in continued decline rather than recovering.

“At present ... there is practically no mature timber left, except a very few culled patches of 5 or 10 acres, or less, where for one reason or another, a clear cutting was not made. This timber has at present little commercial value, and serves only to show the character of the original forest. Mature trees, which are either defective or of inferior species, are scattered widely over the entire tract. The best stands of second growth are found in the coves and on the lower slopes. The ridges

---

<sup>5</sup> Jedediah Hopkins, (1878), Title, quoted in. Lauralee Rappleye, 1981, Interim Report on Catherine Furnace, 34

are often bare of tree growth. ... Through overcutting, slopes and ridges have been left bare, and no attempt has been made to dispose of the brush. Fires have inevitably followed the cutting, and have swept over the slopes and ridges, killing most of the young growth. Bare rock and thin soil have as a consequence, been left exposed.”

All the clearing affected Cub Run and adjacent streams. “The removal of the timber and the repeated burnings have materially affected the stream flow. Farmers living near the tract say that during the wet seasons the streams are much higher, and floods are more numerous than they were fifteen to twenty years ago, when the mountains supported a fair stand of timber. Logging roads through the gaps, have been washed so badly by floods, that they are will nigh impassible. In the dry seasons of summer and early fall, springs and wells of the vicinity, which never failed before the timber was removed, now go dry.”<sup>6</sup>

---

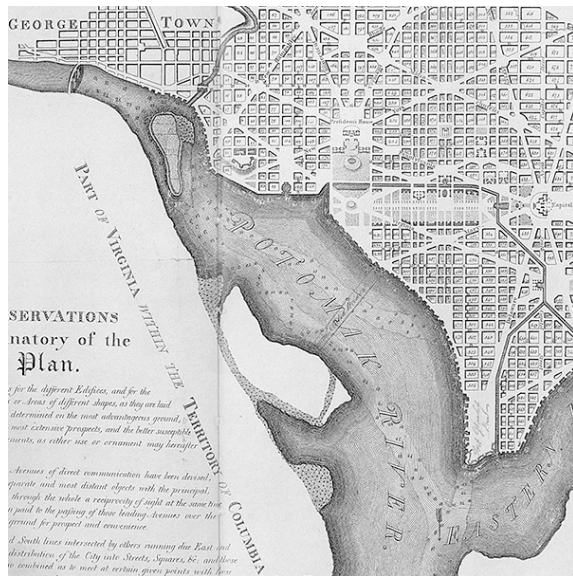
<sup>6</sup> (Clark and Volkmar, Technical Examination, p. 5 - 7)



Regardless of whether soil loss originated from subtle but persistent erosion from farmland or the dramatic loss of mountainsides, all the eroded soil in the upper watershed had to go somewhere, and the inevitable collecting point for much of it was Washington. Like other cities of the mid-Atlantic, Washington straddles the threshold between two geological provinces, the Piedmont and the Coastal Plain. As the Potomac flows out of the rolling uplands of the Piedmont and onto the flat Coastal Plain, it changes from a relatively narrow and fast moving river to a broad, shallow tidal river, a brackish mix of fresh and salt water. That geologic boundary may not be as sharp as a line on a map, but the threshold is surprisingly evident when the river reaches Georgetown, the area's original port city and the oldest part of Washington. Just upstream, the fresh water of the upper Potomac tumbled over its last set of rapids and joined the tidal ebbs and

flows of the Chesapeake estuary. For early settlers, this was the point where fresh, drinkable water met tidal, navigable water, and it was an ideal place to settle, as others had also found in Philadelphia, Baltimore, Richmond, and numerous smaller settlements of the mid-Atlantic.

(Spirn)



Ellicott, 1792, Plan of the City of Washington, detail

But the same conditions that made for good settlement also made for lots of sediment. As eroded soil from farms and mountainsides tumbled down the rapids of the Potomac, the speed of the river kept it moving until it reached the Coastal Plain. At Georgetown the river turned sharply, divided into two channels around Mason's Island, and then broadened to nearly a mile wide, slowing down tremendously and dropping its sediment in the shallow, slower-moving water and gradually accumulating as mudflats that blocked navigation.

Although erosion in the upper watershed may have gone largely unnoticed and elicited little comment, the build up of sediment in Washington occurred in plain view, filling up the broad shallows of the Potomac River right at the foot of the Washington Monument. From day to day,

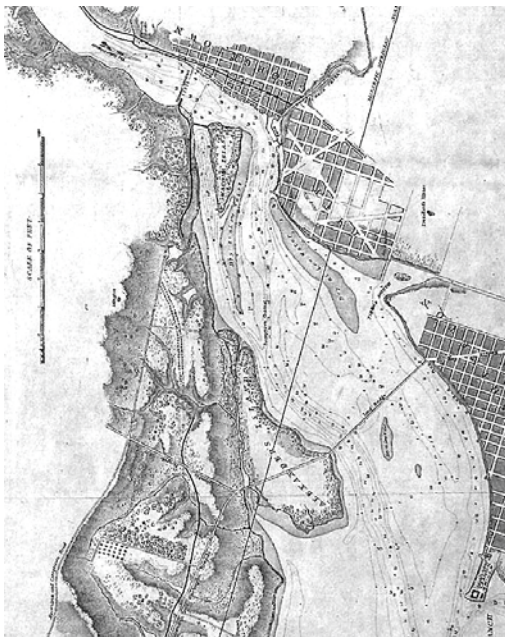
the river wouldn't have been noticeably different, but engineers and ship captains were aware of changes in the depth and navigability of the river, and even doctors were cognizant of the rise of malaria and other diseases associated with the increase of mudflats and marshes in the river. All of this weighed on engineers, planners and lawmakers who needed to address the buildup of sediment and its impacts on commercial shipping and healthy life in the capital.

The accumulation of sediment happened slowly over decades, but the changes are evident in a series of maps of the city that show the channels of the river and the shallower waters between them. As early as 1791, when Pierre L'Enfant laid out on paper his design for the central mall and radiating avenues of the new capital, sediment was already building up in the river. Charles Elliott's modified version of L'Enfant's plan showed the Potomac's three prominent channels and gives evidence of changes in their flow. [Fig. xx] The Virginia channel flowed down the west side of Mason's Island (also known as Analostan Island) and then hugged the Virginia shoreline; the Georgetown channel flowed down the east side of the island and then down the center of the river; and the Washington channel flowed right along the edge of the city itself, continually scouring away at the banks of the new capital and making a good deep harbor along its southwest waterfront. All three channels converged by the time they reached the southern tip of the city where they were joined by the waters of the Anacostia River flowing in from the east. The current in these channels kept them open for navigation, but between the channels, the shallows were probably already filling up with sediment since settlers upstream were clearing more and more of the forests for agriculture, mills, mining and charcoal production.

Two details in Ellicott's engraving hint at changing conditions of the river. At Mason's Island, swampy lowland had established on its northeast shoulder, and tidal mudflats are visible along its eastern side. This suggests that sediment was already building up even before the city

was planned and also shows that the island cast a shadow of slower current that collected extra sediment.

By the early 1800s more sediment was building up below Mason’s Island, so engineers constructed a dam at its northwest corner forcing all the water to the east side of the island hoping that the added current would keep the upper Georgetown channel open to reach its wharves. The dam is visible in William James Stone’s 1841 map of the “Head of Navigation of the Potomac River,” and so is a long mudflat along the eastern side of the island. A second, equally large mud bar formed along the opposite shore, cutting off the head of the Washington Channel. Each of these mud bars is labeled “Dry at Low Water,” but each is just a tip of a larger bar extending downstream below the surface of the river. The lower part of the Georgetown Channel had nearly filled in by 1840, and even the lower Virginia channel appears less navigable than in Ellicott’s map.



Stone, 1841, Head of Navigation of the Potomac River



Boeschke, 1861, Topographical Map of the District of Columbia

By the start of the Civil War, the entire center of the river was less than four feet deep, and ship captains could no longer navigate directly from the Washington waterfront to Georgetown without sailing downriver to the junction of the two remaining channels and then returning upstream via the other channel. This is visible in A. Boeschke's 1861 "Topographical Map of the District of Columbia" which shows an enormous tongue of sediment filling the entire middle of the river with depths marked as shallow as one foot deep. "At low water the soil is entirely uncovered," wrote Major Nathaniel Michler of the U.S. Army Engineer Bureau, "and has become so firm as to support the weight of a man. This development, unless effected by high freshets or other strong natural causes, will continue more rapidly from year to year; the vegetable matter becoming more firmly rooted, will materially aid in checking any floating matter, and cause the material to be deposited in the river."<sup>7</sup>

Michler proposed dredging the main channel along the Virginia side to keep it open all the way to Georgetown and also dredging the Washington channel to maintain access to its wharves. He proposed using the dredge to fill the "Potomac Flats" so it wouldn't wash back into the deeper water. "In this way the water would be confined to the main channel; the flats, now so detrimental to the city, would be reclaimed, and the material taken out could be employed to some useful purpose, instead of being deposited in the river, as had hitherto been the case, to one side or the other, only to be washed back by the current in some succeeding freshet."<sup>8</sup>

Michler's proposal was not adopted, and instead the Virginia and Washington channels were conventionally dredged in 1874 and 1875 with the dredged material simply moved to the side

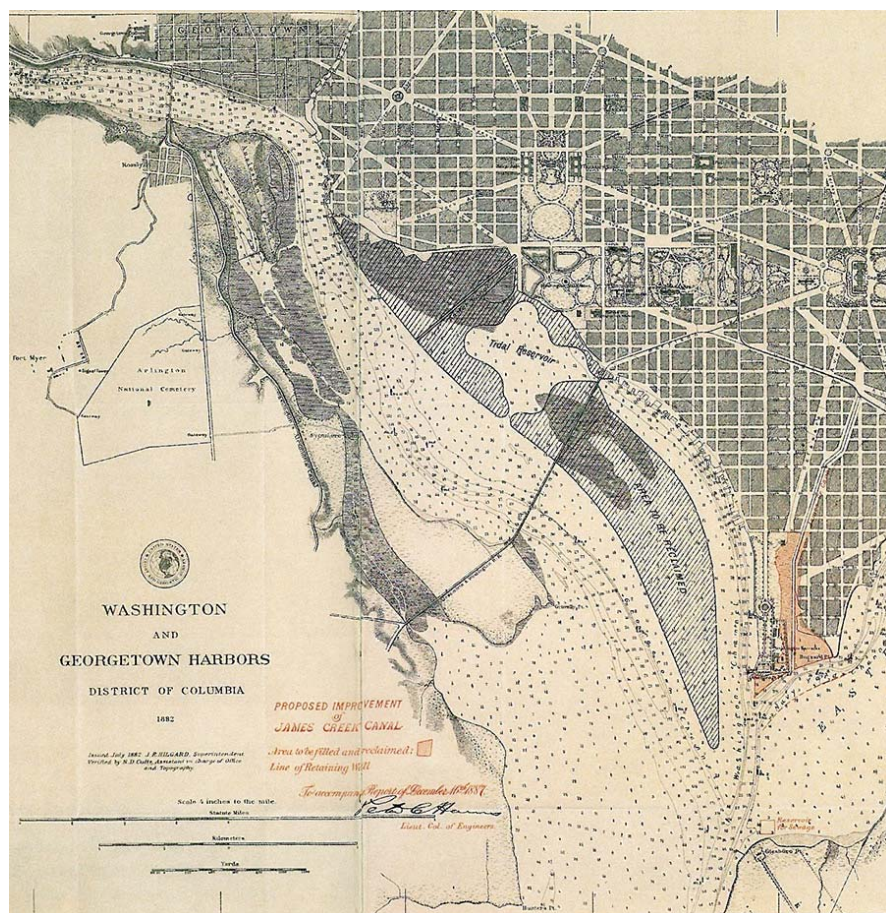
---

<sup>7</sup> (Chappell p. 10, quote 15)

<sup>8</sup> (Chappell p. 16)



where it could wash back into the channel. Just two years later in 1877, the largest flood to date deposited up to six feet of new sediment and “undid virtually all of the work that had been done to improve navigation on the river.”<sup>9</sup>



The flood of 1877 made it necessary to dredge again, immediately, but it also made it clear that a definitive plan for the river was needed. In addition to Michler, several engineers had proposed plans for the river, and in 1882 an Army Corps of Engineers commission approved a

---

<sup>9</sup> (Chappell, 19)



composite of several of them. The plan proposed filling in the eastern half of the river, giving it a new shoreline with a long, gentle 'S' curve, and it also kept the Washington Channel open, forming a long peninsula along the flats. The peninsula would protect the channel from new sedimentation, and a tidal basin at its head would wash it clean with every change of tide. As the tide rose, the basin would fill with water through its southern gate, sediment would drop into the basin, and the falling tide would draw clear water out the eastern gate to keep the channel clear and navigable.

Of course lines on a map do not instantly translate into firm ground under foot, and it would take nearly thirty years before the river was dredged and the new land had been completely filled as shown in the plan. At first, contractors used 'clamshell dredges' that would take a bite out of the bottom of the river, place it on a waiting barge that would dump it next to a newly built railroad trestle. From there, it would be dredged again and put into a railroad car that hauled it to the fill zone. This was slow and expensive, so contractors developed a new system of hydraulic dredging that was much quicker and cheaper. A huge vacuum-like hose could suck up soil and water from the bottom of the river and pump it directly to where they wanted to place it. The outflow was mostly water, so riprap walls were built to contain it to let the mud settle and the water drain off. The whole process was quicker and cheaper, and the suction left a smoother river bottom.

The contractors filled above the high tide point, achieving a rough draft of the new waterfront, but the question remained: how high to build the land? At the start of dredging, the plan was to fill to a level three feet higher than the flood of 1877, but in 1889 the largest flood on record rose to that level so the final elevation was raised by three feet more. New sea walls were constructed along the earlier riprap ones and this gave a more refined, vertical edge to the river.

All of this refinement took much longer than the initial ‘rough draft’ dredging, and it took twenty-one more years until in 1911 the long peninsula along the Washington Channel, the last piece of dry, solid land to be finished, was turned over to the Office of Public Buildings and Grounds. Some of the filled land has subsided since then, especially near the Jefferson Memorial and at the southern tip of the peninsula, but overall the filled land is higher than some of the adjoining land and less susceptible to flooding today.

The deforestation of the upper watershed and the build-up of sediment in Washington were not unique to the Potomac River or even to modern times. George Perkins Marsh’s best-selling book of 1864, *Man and Nature, Or Physical Geography as Modified by Human Action*, described this as a recurring phenomenon throughout the newly settled regions of the United States and with precedents dating back to classical times. Marsh, a native Vermonter, witnessed the clearing of his home state’s forests during his childhood in the early 1800s and the resulting erosion of soil into the region’s rivers. Later, as a foreign minister in Turkey, Greece, and Italy the mid-1800s, he found the same problem had beset cities in the eastern Mediterranean after ancient Greeks and Romans had cleared their mountains of forests. Rivers silted in, and cities struggled to keep their harbors open.

In *Man and Nature*, Marsh synthesized his personal observations in Vermont with historical information from the eastern Mediterranean and contemporary scientific research, and he identified and articulated the link between deforestation, erosion and sedimentation.

“With the disappearance of the forest, all is changed,” he wrote. “The face of the earth is no longer a sponge, but a dust heap, and the floods which the waters of the sky pour over it, hurry swiftly along its slopes, carrying in suspension vast quantities of earthy particles which increase the abrading power and mechanical force of the current, and, augmented by the sand

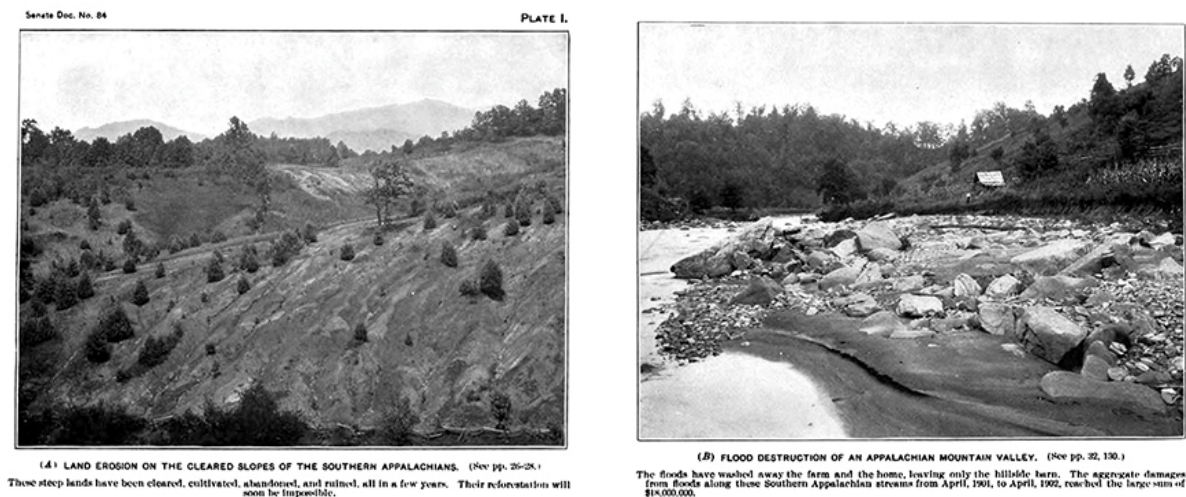
and gravel of falling banks, fill the beds of the streams, divert them into new channels and obstruct their outlets. The rivulets, wanting their former regularity of supply and deprived of the protective shade of the woods, are heated, evaporated, and thus reduced in their summer currents, but swollen to raging torrents in the autumn and in spring. From these causes, there is a constant degradation of the uplands, and a consequent elevation of the beds of watercourses ... The channels of great rivers become unnavigable, their estuaries are choked up, and harbors which once sheltered large navies are shoaled by dangerous sandbars.”

(Marsh, 186-7)

Marsh’s warnings were not abstract ideas observable only in distant places or in past time periods, but were very evident in the immediate landscape. Farmers downstream from Catherine Furnace complained of dangerous floods and their wells running dry after the forest had been destroyed upstream, and in Washington the problem of sedimentation clogging the harbors was plainly evident. The record setting floods of 1877 and 1889 occurred when the watershed was at the peak of deforestation and not long after Marsh’s book was reprinted, and the immediacy of such events probably contributed to the success and impact of the book. Like Rachel Carson’s *Silent Spring*, published ninety-nine years later, it galvanized the population, and deforestation became the leading environmental cause of the late nineteenth century. (Lowenthal) As stated in the beginning of this paper, Theodore Roosevelt’s proposal for a national forest in the southern Appalachians and the Senate Park Commission plan for the park system of Washington are direct responses to the environmental consequences of deforestation in the watershed.

Roosevelt’s national forest proposal was clearly influenced by Marsh’s writing. To make the link between deforestation, erosion, flooding and sedimentation, it paired images of erosion on steep deforested mountainsides with images of rivers and farms severely damaged by flooding

and build-up of sediment. The report plainly described these conditions in the accompanying text. “The soil, once denuded of its forests and swept by torrential rains, rapidly loses first its humus, then its rich upper strata, and finally is washed in enormous volume into the streams, to bury such of the fertile lowlands as are not eroded by the floods, to obstruct the rivers and to fill up the harbors on the coast. More good soil is now washed from these cleared mountain-side fields during a single heavy rain than during centuries under forest cover.” (Forest Proposal)



The southern Appalachians were the likeliest location for a new national forest. They are the largest mountainous region in the east and are blanketed with the most substantial deciduous forests in the nation, and when Roosevelt took office they were still largely pristine and unlogged. The combination of steep mountains, narrow valleys and heavy rainfall made them particularly susceptible to devastating erosion if logged irresponsibly, and the devastation would be especially severe in the agricultural valleys downriver from the mountains and all the way to the harbors at the mouths of the rivers.

Roosevelt’s proposal, drafted by Secretary of Agriculture James Wilson, aimed to protect the forests and mountains from uncontrolled industrial logging, which was encroaching upon the region. In keeping with Marsh’s argument, it stressed that deforestation would devastate the

rivers flowing out of the mountains, as well as the adjacent farmland and the harbors downstream. As Roosevelt made clear in his introduction, the relationships between mountains, forests, rivers and farmland pointed to “the necessity of protecting through wise use a mountain region whose influence flows far beyond its borders with the rivers to which it gives rise.”

For all of the strength of its argument, Roosevelt’s proposal was not adopted during his presidency, however ten years later Congress passed the Weeks Act in 1911 authorizing the purchase of lands for the creation of numerous national forests in the east. Lands were to be purchased from willing sellers only and within delineated boundaries. Among these areas was the Massanutten range, part of the proposed Shenandoah National Forest, and in 1912 one of the very first purchases of eastern forest land was a 17,000 acre property near the southern end of Massanutten, land that had been devastated by charcoal production for Catherine Furnace.

Simply purchasing the land was not enough to protect the forest and restore the watershed however. As evidenced in the 1912 survey of the property, the forests and mountainsides were not regenerating well, and appeared to be still in decline thirty-five years after iron production stopped. Reforestation was a result of frequent and continuous acts of cultivation by the U.S. Forest Service through specific management practices that included fire suppression, erosion abatement, and planting of seedlings. Massanutten was the pioneer district with regard to several key management and restoration practices. It was the first district to receive fire towers to spot fires and aid in suppressing them, and during Franklin Roosevelt’s presidency, the first camp of the Civilian Conservation Corps, Camp Roosevelt, was established on Massanutten, and its workers constructed erosion control structures and planted seedlings across the newly acquired Forest Service lands. Due in large part to these efforts, Massanutten is blanketed with forest

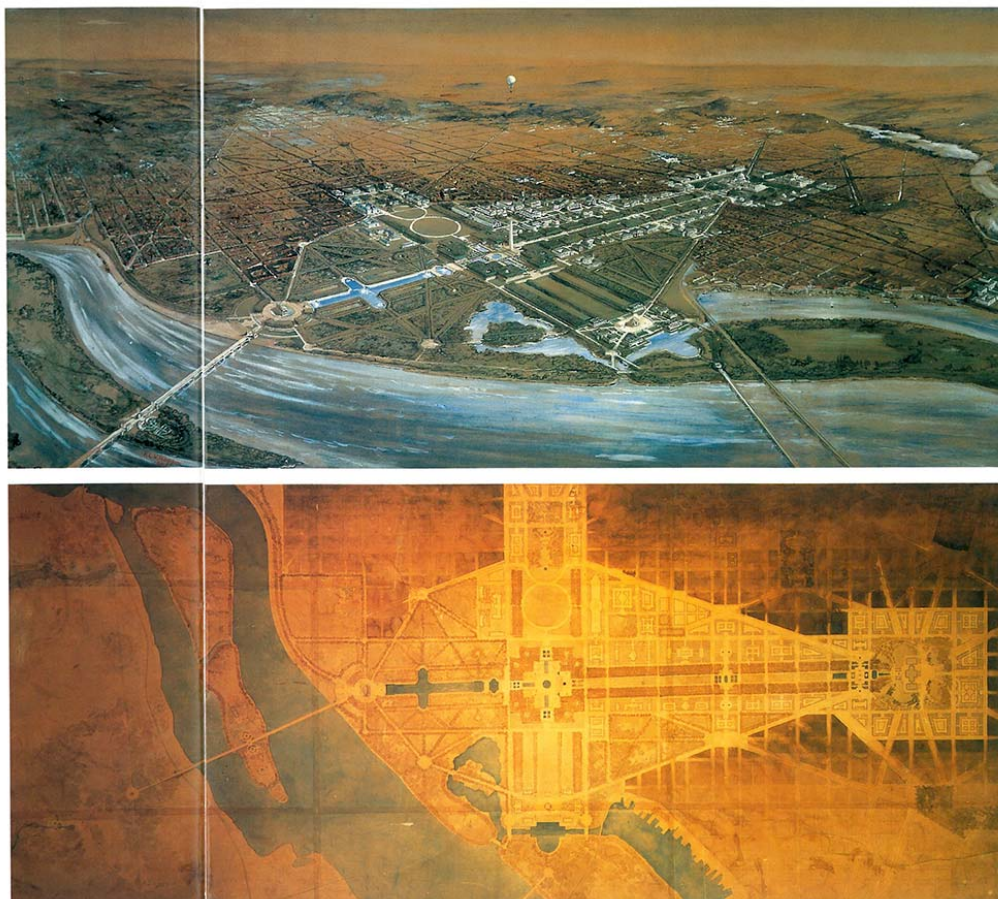
today, and its soils no longer erode dramatically into the Shenandoah River and downriver to Washington.



Roosevelt's national forest proposal was a direct response to the erosion in the Potomac watershed and others like it along the eastern seaboard. The Senate Park Commission plan for the park system of Washington is a less obvious response to the erosion, but it was motivated at least in part by the need to decide what to do with the newly filled lands in the heart of the city. While the land's fate as part of the National Mall seems preordained from today's perspective, it was far less obvious in the late 1800s as dredging was still creating the new waterfront of the capital. Railroad companies wanted the land for new rail yards, developers wanted to expand the city's core, and President Grover Cleveland thought it would be good for use as vegetable farms to grow food for the city's residents. But in the end he signed Congressional legislation to make it parkland.

Architect Daniel Burnham and landscape architect Frederick Law Olmsted, Jr., were the lead planners on the commission, following the precedent set by Burnham and Olmsted, Sr. in the design of Chicago's World's Columbian Exposition in 1893. The baroque grandness and neo-classical architecture of that exposition were an important influence on the proposal for the mall with its white limestone museums and monuments, but so was the presence of another feature of the Chicago fair. (Howett) In the midst of all the architectural splendor of the fairgrounds, Olmsted, Sr. had included a small wooded island, named the Wooded Isle. Although initially he had wanted the island to be a natural respite in the heart of the fairgrounds, it became the site for the Japanese pavilion, which was designed to fit in among the trees with traditional Japanese architecture, and still served as a respite, in clear distinction from the neo-classic architecture of the rest of the constructed lagoon.





While the fair was in full swing and attracting thousands to the “White City,” and while dredgers were filling the future grounds of the national mall, Mason’s Island, now called Analostan Island, was gradually accumulating sediment along its eastern side and also downstream in the quieter water protected by the island. In the Senate Park Commission plan, Olmsted, Jr. proposed Analostan Island to be a forested island in contrast to the neo-baroque splendor of the mall, much like his father had proposed the Wooded Isle at the Chicago World’s Columbian Exposition. In the plan, a second island, created entirely through sedimentation, extends Analostan Island downstream, so that it would fill the background of views from the Lincoln Memorial and the National Mall.



As with the forest on Massanutten, the woods of Analostan Island needed cultivation. The island had once been a plantation and summer home of George Mason IV, the son of a founding father, who used the island to help develop suitable agricultural plants for the new nation. Mason abandoned the island in 1820 (?), and since then the island had been used for a variety of purposes, including military training for African American troops in the Civil War, and its vegetation had apparently been frequently and variously disturbed throughout the nineteenth century.

In 1932, the island was renamed Theodore Roosevelt Island as a living memorial to the former president known for his conservation agenda and his various exploits in the wild lands of the Adirondacks, the Dakotas and beyond. Frederick Olmsted, Jr. developed a plan for reforestation that included removal of undesirable vegetation and planting of species that would grow into a typical forest of the mid-Atlantic coastal plain and piedmont. During the 1930s workers from the Civilian Conservation Corps cleared and planted the island following Olmsted's plan, redirecting its path of succession. Other disturbances, including frequent flooding of the lowlands, construction of an interstate highway bridge across the island, and construction of a more architectural monument to Roosevelt in the middle of it, have continued to alter the vegetation, but the forest has established and grown into a surprisingly diverse forest, including mature upland woods, frequently disturbed floodplain forest, and open marshland. And it does indeed serve as a bit of a respite from the city as envisioned by Olmsted, Jr.

That same year, 1932, was George Washington's 200<sup>th</sup> birthday, and as one of the many acts of commemoration, the Shenandoah National Forest was renamed the George Washington National Forest, which also distinguished it from the newly created Shenandoah National Park along the adjoining Blue Ridge. It is unclear why the forest was named for Washington. Perhaps

this was because, like him, the forest was ‘first’ among eastern forests in so many ways; or because Washington himself had worked to open the upper Potomac watershed for settlement; or because at Mount Vernon he eschewed European plants and cultivated a distinctively American garden. My guess is that it was less for any specific reason, and more likely that the forests were considered an important part of the American landscape, worthy of association with the first president. In any case, naming the forest after him was part of a nationwide celebration commemorating his legacy to the nation, and the forest was part of that legacy.

In this context, what is perhaps more telling is that these two forests, the Theodore Roosevelt Memorial and the George Washington National Forest, signal an important change in the role of forests in the national landscape. Less than one hundred years earlier, forests were being cut rampantly on steep mountainsides, which were eroding and filling up waterways with sediment. By 1932, these same forests had regenerated along with conscious human cultivation and were deemed to be of enough value to commemorate important past presidents. Being consecrated in this manner also gave the forests added stature, stamping them with a seal of approval that testified to the changing perception of the forest in the American imagination, and the numerous acts of cultivation and conservation that revived the forests as part of the watershed. No longer were they a resource to be exploited, but were valued for their role in protecting the watershed and as larger symbols of our nation, including at the heart of the capital.

*References and Footnotes are very incomplete. The following list is from the abstract and does not represent the completed work.*

## REFERENCES

Gordon Chappell, “Historic Resource Study East and West Potomac Parks: A History”, (Denver, CO: National Park Service, 1973).

Kenneth Koons and Warren R. Hofstra. *After the Backcountry: Rural Life in the Great Valley of Virginia, 1800-1900*. (Knoxville, TN: University of Tennessee Press, 2000).

David Lowenthal, *George Perkins Marsh: Prophet of Conservation*, (Seattle and London: University of Washington Press, 2000).

Iris Miller, *Washington in Maps: 1606 – 2000*, (NY: Rizzoli International Publications, 2002).

National Park Service, “Cultural Landscapes Inventory: Theodore Roosevelt Island”, (Washington DC: National Park Service, 2010)

Lauralee Rappleye, “An Interim Report on Catherine Furnace: An Historic Cold Blast Charcoal Furnace near Newport, Page County, Virginia”, (Page County Historical Association, March 1981).

Jean L. Satterthwaite, “George Washington National Forest: A History” (Atlanta, GA: U.S. Dept. of Agriculture, Forest Service, Southern Region, 1981).

Senate Park Commission, “The Improvement of the Park System of the District of Columbia”, (Washington DC, 1902).

Paul Kelsch is an Associate Professor in the Landscape Architecture Program at Virginia Tech’s Washington Alexandria Architecture Center. He has professional degrees in Architecture and

Landscape Architecture and a PhD in Cultural Geography. His research focuses on the expression of nature in designed landscapes, and he is currently working on a study of the Potomac River as a symbolic and natural backdrop to the monumental core of Washington DC.



COUNCIL OF EDUCATORS  
IN LANDSCAPE ARCHITECTURE

*A CELA Conference Presentation*

*Abstract ID: 271*

## **A REVIEW OF CRIME PREVENTION THROUGH ENVIRONMENTAL DESIGN STUDIES IN CHINA, 1985-2015**

**WANG, JINGJING (JANE)**

PhD Candidate, Landscape Architecture, Beijing Forestry University, China

**MICHAEL, SEAN E.**

Professor and Department Head, Landscape Architecture and Environmental Planning, Utah State University

**ZHU, JIANNING**

Professor, Landscape Architecture, Beijing Forestry University, China

### **ABSTRACT**

*This Since its emergence in the 1970's, a wealth of studies related to crime prevention through environmental design (CPTED) have been conducted in North America and the United Kingdom. In contrast, little attention has been paid to this field by Chinese scholars. Understanding the extent to which CPTED, and environmental criminology more broadly, has reached design audiences in China is the first step in understanding the gap between them and their colleagues elsewhere.*

*This paper provides an overview of how crime prevention has emerged and evolved in China, along with what currently constitutes the 'state of science' in China. An analysis of publications pertaining to CPTED over the last 30 years in China is presented, having been identified by the top three Chinese academic search engines. Results have been divided into three categories: theories of the relationship between crime prevention and space; studies of crime distribution; and studies of crime prevention policy plus case studies of strategy implementations. Results are summarized, along with suggestions for future research and dissemination in China.*

### **1.1 Keywords**

CPTED; urban renewal; safety; crime; China

## **1 INTRODUCTION**

Crime prevention through environmental design (CPTED) was first presented by Newman (Oscar Newman 1972) — an American architect and city planner in 1972, in his seminal book

---

The authors are solely responsible for the content of this technical presentation. The technical presentation does not necessarily reflect the official position of the Council of Educators in Landscape Architecture (CELA), and its printing and distribution does not constitute an endorsement of views which may be expressed. Technical presentations are not subject to the formal peer review process by CELA Track Chair System; therefore, they are not to be presented as peer-reviewed publications. Citation of this work should state that it is from a CELA conference paper. EXAMPLE: Author's Last Name, Initials. 2014. Title of Presentation. CELA Paper No. 14-xxxx. Baltimore, Maryland: CELA. For information about securing permission to reprint or reproduce a technical presentation, please contact CELA at [dsolco@uta.edu](mailto:dsolco@uta.edu) or 817-272-2321.

Defensible Space: Crime Prevention through Urban Design. In the same year, Jeffery (C.R. Jeffery 1971) who worked in the same university with Newman published his work as Crime Prevention through Environmental Design. These two scholars were the most important founders of CPTED. But if we trace back to earlier time, Jane Jacobs 's *The Death and Life of Great American Cities* (1961) did much to challenge contemporary ideas about planning (Paul and Terence 2015).

This article provides an overview of the origin and development of the studies on Crime Prevention through Environmental Design (CPTED) in China from the year 1986 to 2015, and only discusses the development of CPTED exclusive of other theories pertaining to crime prevention by environmental strategy such as broken window theory or environmental criminology. This research analyzes the collected papers from different aspects, such as numbers of papers from different time or of different research topic. The paper focuses on how deep analysis these papers are, what are the study trends and what themes the scholars tended to choose of the papers.

Since the emergence of CPTED, countries like America, United Kingdom, Australia, Canada, etc., have made great development on CPTED research supported by their governments, not only in theory building, but also in actual implementation. Meanwhile, these countries have set laws and policies based on CPTED theories for security. Many of the studies have demonstrated that implementations of CPTED can really help reduce crime rate. However, few findings and researches have been done since the emergence of CPTED in China. Although recently, more and more scholars in China start to delve into this field, few of them have made breakthrough in theory building and implementation. The rapid pace of China's urbanization continues to pose challenges for its public safety system—increasing crime rates have emerged as an urgent problem to be solved. If advancements in environmental criminology do not constitute an element in those solutions, a proven strategy of Western law enforcement and design disciplines will have been lost.

## **2 METHODOLOGY**

The paper collection process plays a critical role in this review. Therefore, the top three Chinese academic search engines — China Knowledge Resource Integrated database, WEIPU Data, WANFANG Data, have been used as primary sources for this review because of their comprehensiveness and authority. After carefully selecting and synthesizing, almost two hundred papers published from 1986 to 2015 have been collected from searches conducted in these top three academic search engines, which include the most useful databases—CJFD (China Journal Full-text Database), CDFD (China Doctoral Dissertations full-text Database), CMFD (China Master's Theses Full-text Database), CPFDD (China Proceedings of Conference Full-text Database), CCND (China Core Newspaper Database) in China, Which can guarantee accuracy of this review in a great degree. The collections of CPTED related papers are searched by the following key words: safety; urban security; CPTED; crime; space; environmental design.

## **3 FINDINGS**

Ten years after the findings by C. Ray Jeffery (1971) and Oscar Newman (1972), research articles in this field began to emerge in China. Before 2000, there are less than five research articles can be found each year. While in 2008, the number of articles has increased dramatically in the form of both journal articles and dissertations. All of the papers collected in this review are categorized by their content into these following three subsections: theories of the relationship between crime prevention and space; studies of crime distribution; studies of crime prevention policy plus case studies of strategy implementations.

### **3.1 Theories of the relationship between crime prevention and space**

This subsection includes one hundred and ten papers which were analyzed from four aspects: crime prevention theory introduction and project implementation introduction of Western countries; crime prevention through planning or city design; crime prevention strategy in communities, crime prevention in schools and parks, etc.; crime prevention strategy in public architecture area.

Many Chinese scholars have done research of CPTED theory. CHEN gives an general expression of city planning and crime control in 1994 (H.R. Chen 1988). Chen (F.H. Chen 2003), Xu (L.Q. Xu 2003), Rong (X.H. Rong), Liu (G.S. Liu & Y. X. Li 2008), Yang (Y. Z. 2011) and Mao (Y.Y. Mao 2008) who all published their articles with high-cited number, which reviewed the foreign or domestic studies about the relationship between environment and crime, which made a great influence to the future study in this field. Based on their work, a framework was brought forward for systemically studying the relationship between environment and crime. Li (B.S. Li 2010) deems implementation of CPTED as environmental evaluation of crime risk in his paper Broken Window Theory and American Crime Control. Doctoral Dissertation written by Ma introduced theories and strategies of crime prevention, and shared some experiences and problems of plan and design about reform of the physical environment by comparing Western countries with China (R. Ma 2010). Regarding of Western countries' projects, in the year of 1994, D.Q. Li translated an article written by M.L. Tucker and B. Starnes called Crime Prevention through Environmental Design: The Tallahassee Model (M.L. Tucker & B. Starnes 1993), which clearly presented the three principles of CPTED and a detailed expression of an excellent case study which is the very first time of introducing CPTED in China.

In terms of case study, research about crime prevention in planning and city design are



generally within these topics, relationship between urban environmental design and security (K. Pan 2009), relationship of environmental landscape image and fear of crime (X. Zhou 2014), urban design based on public security (K.Z. Cai & J.G. Wang 2008). Moreover, due to the rapid pace of China's urbanization, a large amount of crime problems emerged at the urban-rural fringe and the urban village which drew many scholars into finding the solution to this Chinese particular problem.

Since the 2000s, a wave of studies in the field of communities design, school and university design, park design by the means of CPTED rise up. More journal articles can be found, as well as more dissertation studies in this field (e.g., Z.J. Chen & H.Y. Wang 2010, Y. Cao 2012, L.P. Zeng 2010, H.Y. Cui 2014, L.H. Zhang 2015, X.H. Xie 2009, F.H. Fan 2011, R.J. You 2013, X.H. Zhou 2009, L.H. Peng 2011, G.S. Liu 1994, H.Y. Wu 2015, D.P. Chang 2007, Y. Liu 2009, D.C. Sun 2012, H.Y. Cui 2011, Y. Lu 2010).

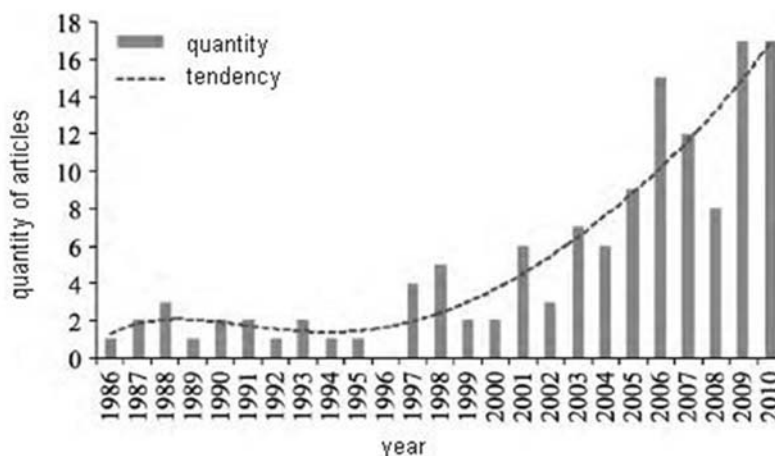
The forth part of crime prevention strategy in public architecture area includes the space of plant, company building, hospital and some other spaces. "Part of factors of rising crime rate is due to more districts with nobody use by human behavior. Zhu (X.G. Zhu 1988) defines the definition, object, environment characteristic, criminal characteristic and pattern of environmental criminology in plant, relationship between plant environment and crime, discuss the meaning and trend in the end of his paper, which initiate the study in plant field.

In addition, H.Z. Chu, professor in Peking University, who presented his own theory called "Field theory of Crime" which is really similar to CPTED theory. Although his work is not based on CPTED, the theory cannot be ignored when talking about CPTED study in China. The concept of crime field is a potential criminal offense people to achieve the objective criminal purpose with the victim under the influence of each game in order to commit a crime of specific field or specific area where criminal behavior happened in the result of criminal factors (W.Z. Wang 2010). The

theory focuses on the objective and subjective of crime, and trying to find solutions to reduce the chance of committing crime. The field of crime controls the means of implementation of crime commitment in the concrete by resisting crime field formation. Chinese scholar could be inspired by both crime field theory and CPTED for the future study to make more contribution and breakthrough in reducing crime.

### 3.2 Studies of crime distribution

This paper dives into providing an overview of the development of CPTED in China to reflect the study status and trend, without showing a list of all the papers published. It tends to regard crime distribution as a strategy in the system of CPTED theory, and some design discipline of CPTED as a strategy to crime geology. Based on the key words searching, only ten papers have been found which seems too few compared with papers provided by Jiang (C. Jiang, H.L. Tang & L. Liu 2014) who presents an overview of crime geology in China in the past twenty years depending on more than one hundred paper (Figure1). But as said in the beginning, different search key words lead to different paper achieved which can also provide an objective view of the current study status.



**Figure1. Articles quantity published in scholarly journals on crime geography (Cited from C. Jiang and H.L. Tang, 2014)**

Chinese scholars took steps into CPTED in this part of study quite early. In 1986, Wang and Zhu began to make inroads into crime geology. Wang presented the origin and evolution of crime geology, and gave a comprehensive instruction of crime mapping school, crime spatial ecology theory, Chicago spatial model, urban crime district and defensible space (F.Z. Wang 1986). Unlike Wang, Zhu lists some policies related to crime distribution that Chinese government should implement to reduce crime in a non-systematical way. And Zhu is the first scholar promoting crime geology study in China. Their works undoubtedly pose a great influence to the Chinese future studies in this area (X.G. Zhu 1986).

Crime mapping is the main strategy in the field of Crime distribution study. After 1997, some new contributive and creative research had been done. Cheng and Ma discussed the characteristic of Beijing urban crime and distribution law of time and space, then, provided ideas about warning prediction area dividing and comprehensively social control measure (L. Ma & L.S. Cheng 1997). It gives a detailed and complete statistics of monthly crime map in Beijing which shows urban-rural fringe has the highest rate of crime and enlightens the following study. Du used GIS and method of regression analysis to conduct a research of Edmonton, Canada. The results show that “the nearer a neighborhood is to the city center, the higher its crime density is”, “neighborhoods with higher population density have higher crime density”, “commercial districts have the highest crime density among all types of land uses” (D.B. Du 1998). With the technology of ArcView and SPSS as well as descriptive statistics, correlations and regression analysis method, Mao found the similar results as Du that crime density decreases from center city to outer suburban district (Y.Y. Mao & S.Z. Dai 2006).

Crime shows significant spatial and temporal aggregation which is called “crime hot spots”. Lu with others summarizes the crime hot spots research and finds “relatively fewer related domestic

research that we should enhance some methods for crime analysis in combination of China's national conditions. In addition, some breakthroughs and innovations need to be made in the research methods for the spatiotemporal distribution of crime hot spots through in-depth research of the crime theory and the research in other fields as a reference (J. Lu et al. 2012).” By analyzing crime hotspots mapping of almost two thousands cases of theft crime, Shan found crime hotspots about sections and grids can be effectively detected and accurately calculated, “the aggregate distribution of crime was figured out in different communities, different roads and different lands. This idea has been tested and has become a new choice to promote the ‘Green Chinese Building’ in a higher level” (Y. Shan & C.J. Ruan 2013).

All in all, domestic scholars are interested in introduction of international theories and design principles and keep developing new study area. They have used international advanced technologies proficiently for profound research. An increasing number of domestic case studies are found and in an increase rate year by year. But due to the lack of basic and particular data, crime distribution study cannot be researched deeper in China.

### **3.3 Studies of crime prevention policy plus case studies of strategy implementations**

There are sixty-two papers that have been collected in this subsection falls into this category. Among these sixty-two, six of them are unscramble and instruction of western countries (e.g., North America (H.Y. Cui 2011), Sweden (Z.X. Gu & H.L. Gu 2012), Germany (M.M. Shen 2011)). Domestic case studies in China focus mostly on large population cities (e.g., Beijing, Guangzhou, Shanghai, Changchun), and few in other cities (e.g., Xi'an, Chongqing, Harbin, Xiamen). The researching places of CPTED are various and relatively comprehensive as western study, including urban park, activity space for children, community space, urban commercial area, urban street

space, and urban underground transportation spot.

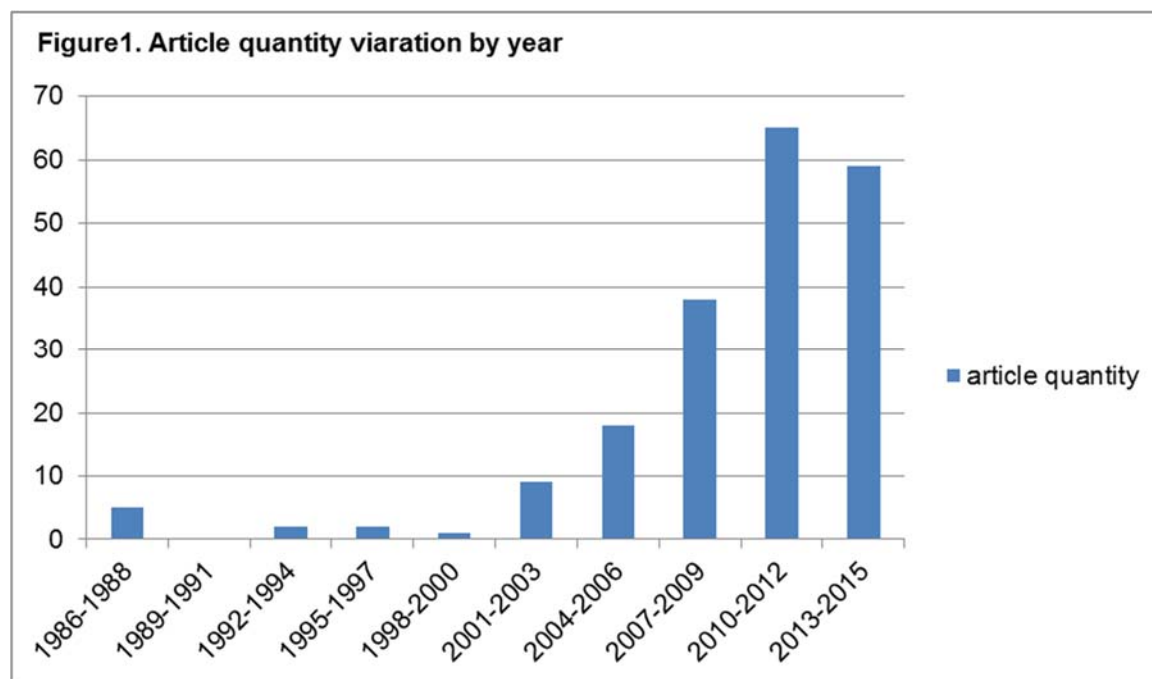
The work of crime prevention case studies of strategy implementations are in an increasing trend in China while no policy study has been found because of support deficiency from the government. At least it shows so in all the collection of papers. If Chinese government can regard effective crime prevention as one of the objectives in its regulatory plan, it would have a significant meaning and value, presented in the doctoral dissertation of Liu (D.Q. Liu 2012). A systematical and detailed analysis of crime distribution and other characteristics in Changchun, Liu provide some feasible strategies in the view of urban manager and governor, which is definitely a good exploration of policy enactment. A case study of village in Daxing district in Beijing set a good example of community based management of village by CPTED methods and principles (X.Y. Zuo & Z.L Yuan 2012). In addition, there are studies which draw different conclusions from the existing theories and findings in western countries (e.g., Y.Y. Mao & J.J. Ding 2014). Take Pudong New Area as an example. It studies the environmental factors affecting crime in residential area and examines the applicability of the theories and experiences from western countries into Chinese residential areas. Therefore, Chinese scholars should conduct more case studies like this and find a compatible way of CPTED implementation in China.

## **4 CONCLUSION**

### **4.1 Insufficient study**

The number of valuable articles is increasing (Figure1), but still lack of evident of CPTED. Most studies in China in this area were trying to research theories or principles based on existing results. Also, most of them directly are used or modified existing strategies from Western countries. CPTED cannot be clearly evaluated by its own to demonstrate the real role of reducing crime might

be another reason why CPTED was not chosen by Chinese scholar for deeper research. But Formal evaluation of CPTED projects and evaluation of the value of CPTED interventions in crime prevention is important (Paul and Terence 2015). Without evaluation, it will never be clear when, where, and why such programs have been effective (Zahm 2005). When taking strategy of CPTED in a site and found the crime reduced, how can you say it is the CPTED worked while other reasons might be exist, such as incidental factors, crime displacement. Although a wealth of research has been done in western countries, a large amount of them is in a not enough roundly way and can be challenged.



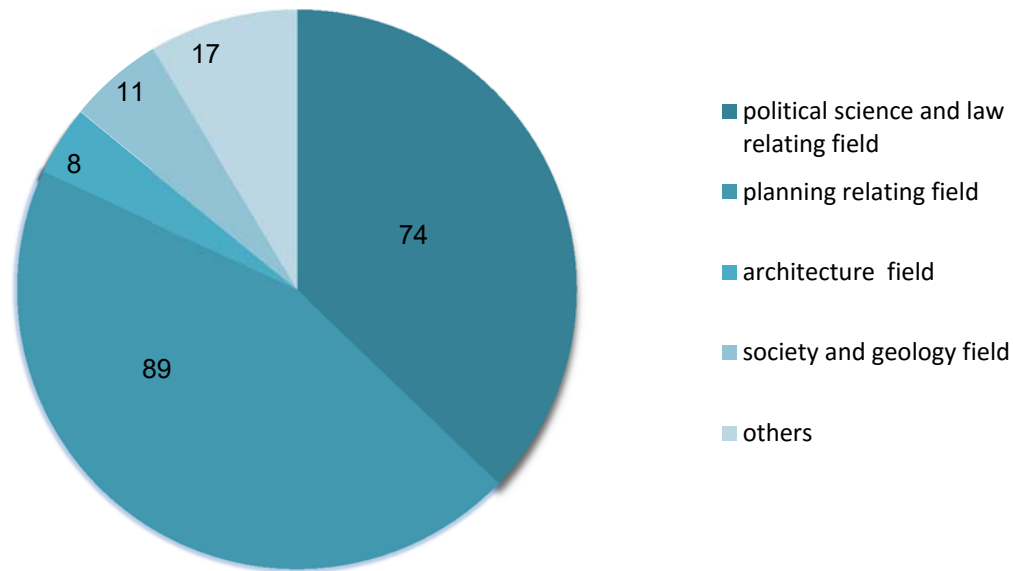
#### 4.2 Restrictions of research in China

In a start status of CPTED research, Chinese scholars have a long way to keep abreast of Western counties. A more completeness and systematical theory should be done in the first place for study enrichment. Compare with micro urban design, more work need to do in macro urban design in China.

The reasons behind why CPTED study has been neglected by Chinese scholars are simple, while the solutions may be complex. Besides personal scholarly interests, few Chinese landscape architects or planners have made inroads into this field because of the difficulty of accessing sufficient crime data without first obtaining governmental clearances and authorization. When talking about limitations of the research in China, we cannot ignore the background of academic scholars. This research classifies them into five types: academic background of political science, law or criminology, work at People's Procuratorate, court or police station; study of work in the field of planning and related areas; architecture field; sociology and geology field; other field (Figure3).

The numbers of articles are in a good increasing rate, but still in a status of introducing new theory or strategy or using existing strategy in Chinese case. Lacking of basic data is still the main limitation for the CPTED study in China (Y.Y. Mao & S.Z. Dai 2010). It is difficult to find detailed criminal offence data which includes criminal type and the location of the crime, not only the district and the number of all crime in a large district. It limits the study in criminal spatial factors in a microscopic analysis rather than directly factors influenced Data obtained in different times might turn to a deviation of results. "CPTED is now supported by the United Nations (United Nations Human Settlements Programme 2007) and by governments all over the world including the United States, Canada, the United Kingdom, Australia, New Zealand, and throughout Europe. There are also CPTED standards for US Federal Facilities and the Federal Emergency Management Agency (Atlas 2013)." Not just western countries' government support CPTED, it is evident in parts of Asian governments-including Japan, South Korea, Malaysia, Singapore. CPTED can make more contributions to China if the government can support the research and law enforcement.

**Figure3. Pie figure of article quantity by author's background**



## **5 PROSPECT**

CTPED is in a specialized, practical and legal way in Western countries, while China's study of CPTED still has a long way to go. The rapid pace of China's urbanization is continued. As with all nations, police are grossly outnumbered in dense urban population centers, and face great difficulty in thwarting criminals. In China as elsewhere, omnipresent crime prevention strategies offer one strategy for this dilemma and can help ameliorate lives of citizens, especially people who are struggling to life living in the disorganized urban-rural fringe. As a strategy of reducing crime, CPTED is a potential influencing one for China. First, as one of the world's most populous country, an affective crime strategy can change a lot in many ways. Moreover, in road of urbanization, a large amount of buildings and new spaces would be built. Why don't we use effective strategy to build safer cities? Police is necessary, but if the city itself can prevent crime, it would be a time-saving and resource-saving thing to use CPTED before or during constructions. Also, more communities are being built or rebuilt. CPTED can help government create better places



for their citizens. In addition, just because we are in the time of urbanization, it is better to seize this opportunity to implement CPTED with real estate developer and in policy set with government, which can make a great contribution to the future CPTED research in China. The number of Chinese studies in this field is still relatively small and in a basic degree of space management application, which might lead to an incomplete forecast of the results after the strategy implementation. If more attention were to be paid by urban manager, planner, architect, and government along with enhanced cooperation of different subjects, we will build a safer and harmonious society (R. Ma & W.Y. Zhu 2011) here.

## 6 REFERENCES:

- Atlas, R., ed. (2013). *21<sup>st</sup> Century security and CPTED: designing for critical infrastructure protection and crime prevention*. 2<sup>nd</sup> ed. Boca Raton, FL: CRC Press.
- Cai, K.Z., & Wang, J.G. (2008). Urban design based on public security – discussion of safety urban design. *Architectural Journal*.
- Cao, Y. (2012). *Concerning the environment management of urban community and community Policing* (Unpublished master's thesis). Southwest University of Political Science and Law, China.
- Chang, D.P. (2007). *The study on safety programming and designing of urban residential districts* (Unpublished master's thesis). Shandong University of Science and Technology.
- Chen, Z.J., & Wang H.Y. (2010). Crime prevention through the design of sports space in residential area. *Huazhong Architecture*.
- Chen, H.R. (1988). Urban overall planning and criminal control. *Law Science*.
- Du, D.B. (1998). Geography study on crime problems of Edmond city in Canada. *Geographical Research*, 17, 4.
- Cozens, Paul, & Terence Love. (2016). A review and current status of crime prevention through environmental design (CPTED). *Journal of Planning Literature*, 30.4: 393-412. Academic Search Premier.
- Cui, H.Y. (2011). Analyze of CPTED under the view of American university violence. *Oversea Use for Reference*.
- Cui, H.Y. (2014). Environmental crime prevention of domestic primary school. *Adolescent Crime Issue*.

- Cui, H.Y. (2011). View of CPTED implementation in North America. *Journal of Railway College*, 21.
- Fan, F.H. (2011). *Study on the landscape of urban public space based on psychological safety* (Unpublished master's thesis). Landscape Architecture, Huazhong University of Science and Technology, China.
- Feng, F.H. (2003). Regression of CPTED theory. *Security Science*.
- Gu, Z.X., & Gu, H.L. (2012). Crime prevention environmental design and improvement of residential security: take Rosengard community in Sweden as an example. *City Issue*, 1, 35-39.
- Jacobs J. (1961). *The death and life of great American cities*. New York: Random House.
- Jeffery C.R. (1971). *Crime prevention through environmental design*. Beverly Hills. CA: Sage.
- Jiang, C., & Tang, H.L. & Liu, L. (2014). Analysis of geography study on China crime. *Progress in Geography*, 33, 4.
- Li, B.S. (2010). Broken window theory and American criminal control. *Study Review*.
- Liu, G.S., & Li, Y.X. (2008). New thought of crime prevention: crime prevention through environmental design. *Law Review*, 432-455.
- Liu, G.S. (1994). Urban residential environment and crime prevention. Shandong *Legal Science*.
- Liu, Y. (2009). *Research of urban residential criminal control* (Unpublished master's thesis), Lanzhou University.
- Liu, D.Q. (2012). *Spatial analysis of crimes in Changchun and crime control from planning and administrative perspective* (Unpublished doctoral dissertation), Northeast Normal University.
- Lu, J., & Tang, G.A. & Zhang, H. & Jiang, P., & Wu, W. (2012). Summarize of study method on spatial distribution of crime hotpot. *Progress in Geography*, 31, 4.
- Ma, L. & Cheng, L.S. (1997). Urban criminal geographic analysis in Beijing. *Human Geography*.
- Ma, R. & Zhu, W.Y. (2011). Preliminary study on spatial strategy of urban social security management: take contemporary Beijing construction as an example. *Beijing Planning and Construction*.
- Mao, Y.Y., & Dai, S.Z. (2006). Crime spatial distribution and environmental characteristics. *Journal of Urban Planning*, 3.
- Mao, Y.Y. & Dai, S. Z. (2010). A review of studies on the relationship between environment and crime in China. *Human Geography*.
- Ma, R. (2010). *Research on the urban physical environment vulnerable to crime* (Unpublished doctoral dissertation), Tsinghua University.
- Mao, Y.Y., & Dai, S.Z. (2008). Analysis and enlightenment of the relationship between urban environment and crime-

- based on the perspective of urban planning. *International Urban Planning*, 23.
- Mao, Y.Y., & Ding, J.J. (2014). Study of relationship between community environment and crime behavior: take community in Pudong new district in Shanghai as an example. *Urban Development Studies*, 21, 4.
- Newman Oscar. (1972). *Defensible space: crime prevention through urban design*. New York: Macmillan.
- Pan, K. (2009). Summary of relationship between urban green land environmental Design and urban security. *Shanxi Architecture*, 35, 352-354.
- Peng, L.H. (2011). Research of urban community security management (Unpublished master's thesis), *Xiangtan University*.
- Rong, X.H. (2004). Urban crime prevention under guidance of environmental prevention theory. *Journal of Zhejiang Police College Public Security Science Journal*, 1, 42-44.
- Shan, Y., & Ruan, C.J. (2013). Aggregation, distribution and spatial anti-crime of urban street crime: analysis of crime mapping based on Geography Information System (GIS). *Legal System and Society Development*, 6.
- Shen, M.M. (2011). Enlightenment of building green community from German residential crime prevention. *Examination Weekly Magazine*.
- Sun, D.C. (2012). Building the defensible system for school injured by crime prevention though environmental design (CPTED) theory. *Educational Legal System*, 16.
- United Nations Human Settlements Programme. (2007). *Global report on human settlements 2007: enhancing urban safety and security*. United Nations Human Settlements Programme (UN-Habitat), Kenya.  
[Http://www.unhabitat.org](http://www.unhabitat.org).
- Wang, W.Z. (2010). *Crime field study* (Unpublished doctoral dissertation). Southwest University of Political Science and Law).
- Wang, F.Z. (1986). Research of overseas urban criminal geology. *Human Geography*.
- Wu, H.Y., & Liu, J., & Zhang, Q.P. (2015). Space syntax analysis for city residential district and landscape design: based on the perspective of crime prevention. *Chinese Landscape Architecture*.
- Xie, X.H. (2009). University environmental influence on teenager: discussion of how to prevent teenager crime by dynamic ability of university. *Legal System and Society*.
- Xu, L.Q. (2003). Research and practice of CPTED in architectural design and community planning. *New Architecture*, 6.

- Yang, Y.Z. (2011). Review of theoretical research of relationship between crime and overseas urban communities environment. *Modern City Research*.
- You, R.J. (2013). *Based on the security of residential area landscape design—Take Shenzhen Vanke town for example* (Unpublished master's thesis). Fujian Agriculture and Forestry University, China.
- Yue, L. (2010). The study on the emotional security space construction in settlements (Unpublished master's thesis). Chongqing University.
- Zahm, D. (2005). Learning, Translating and Implementing CPTED. *Journal of Architectural and Planning Research* 22 (4): 284-93.
- Zeng, L.P. (2010). Study on prevention theory and application of semi-public space. *Guangzhou Police Management Governor School Journal*.
- Zhang, L.H. (2015). Review of university crime prevention through environmental design. *Art Technology*.
- Zhou, X. (2014). The Relationship of environmental landscape image and fear of crime. *Landscape Theory & Study*, 36.
- Zhou, X.H. (2009). Relationship between urban spatial environment and crime prevention. *Shanghai Urban Planning Review*, 3.
- Zhu, X.G. (1988). Environmental criminology of factory and enterprise space. *Shanghai University Academic Journal*.
- Zhu, X.G. (1986). Criminal geology study. *Journal of Hebei Normal University (Philosophy and Social Sciences Edition)*.
- Zuo, X.Y., & Yuan, Z.L. (2012). Crime analysis of village communization management. *Journal of Chinese People's Public Security University (Social Sciences Edition)*, 3, 147-151.

## Author Biographies

**Jingjing(Jane) Wang** is a landscape architect, PhD candidate in Beijing Forestry University. Her research focuses on urban park design through environmental behavior methods, CPTED research. She is interested in sustainable and universal design.

**Sean E. Michael** is a professor and department head of LAEP (Landscape Architecture and Environmental Planning Department). His research focuses on crime in parks and recreation areas, crime prevention and criminal behavior, human responses to the environment, design modules for rails-to-trails and restorative garden design.

**Jianning Zhu** is a professor in Landscape Architecture department, Beijing Forestry University. He founded Beijing Beilindipingxian Landscape Design Institute in 2000. His research and project focuses on urban park and square design, urban planning.



COUNCIL OF EDUCATORS  
IN LANDSCAPE ARCHITECTURE

*A CELA Conference Presentation*

**Abstract ID: 287**

## **INVESTIGATING CLIMATE JUSTICE IN GREEN INFRASTRUCTURE PLANNING: A CASE FOR THE HURON RIVER WATERSHED, MICHIGAN**

**CHENG, CHINGWEN**

Assistant Professor, Landscape Architecture, Arizona State University

### **ABSTRACT**

*Green infrastructure has been recognized as a critical no-regret strategy to address climate change mitigation (e.g., carbon sequestration) and adaptation (e.g., reduce heat and floods) in climate action plans. Climate justice refers to uneven distribution of climate change-induced environmental hazards (e.g., floods aggravated by climate change impacts in terms of their frequency, intensity, and geographical spread) among socially vulnerable groups—the elderly, children, women, migrants, non-whites, and the poor. This paper proposes a climate justice assessment framework to assess the access to green infrastructure in relation to social-ecological vulnerability under the impacts of climate change in order to prioritize green infrastructure planning in climate actions.*

*Climate justice assessment was conducted through hydrological modeling, GIS spatial analysis, and statistical methodologies. A Climate Justice Index synthesized a flooding hazard index, an environmental hazard index, and a Social Vulnerability Index for identifying places where socially vulnerable population would most likely be exposed to environmental hazardous sites susceptible to water quality contamination aggravated by climate change-induced flooding hazards. In addition, a Green Infrastructure Index indicated the access to biophysical adaptive capacity for climate change. A case study for the Huron River watershed in Michigan illustrates that climate justice hotspots are in cities of Wixom, Ann Arbor, and Ypsilanti, where the more socially vulnerable groups are exposed to more climate change-induced environmental hazards yet fewer green infrastructure resources are available. This study demonstrates the value of applying climate justice assessment framework in green infrastructure planning in order to assist decision-making on prioritizing green infrastructure investment while addressing equity in adapting to climate change impacts in communities. The study framework can be applied to other watersheds and cities in order to apply green infrastructure to enhance resilience and sustainability in communities under consideration of climate justice.*

### **1.1 Keywords**

Green Infrastructure, Climate Justice, climate change-induced environmental hazards, adaptation

---

The authors are solely responsible for the content of this technical presentation. The technical presentation does not necessarily reflect the official position of the Council of Educators in Landscape Architecture (CELA), and its printing and distribution does not constitute an endorsement of views which may be expressed. Technical presentations are not subject to the formal peer review process by CELA Track Chair System; therefore, they are not to be presented as peer-reviewed publications. Citation of this work should state that it is from a CELA conference paper. EXAMPLE: Author's Last Name, Initials. 2014. Title of Presentation. CELA Paper No. 14-xxxx. Baltimore, Maryland: CELA. For information about securing permission to reprint or reproduce a technical presentation, please contact CELA at [dsolco@uta.edu](mailto:dsolco@uta.edu) or 817-272-2321.

## **1 INTRODUCTION**

Climate change is associated with increased frequency and intensity of extreme weathers (IPCC 2014) such as two 1-in-500-year storm events happened 15 years apart in Iowa in the year of 2008 and 1993 and the 1-in-1000-year storm event happened in 2014 breaking its previous record for one-day rainfall in 1939 in Phoenix. Climate change-induced environmental hazards have aggravated the extent of impacts on the currently hazard-prone areas. Subsequently, socially vulnerable groups who have less resource to manage risks are likely to suffer more. Social vulnerability can be a factor of demographic, social, economic, and political status in addition to urban context (e.g., age, gender, race, income, immigration status, education, occupation, social welfare and medical resources, housing density) (Walker & Burningham 2011). The concept of climate justice discloses uneven distribution of climate change associated hazards and unequal capacity in socially vulnerable groups to mitigate hazards and adapt to the impacts from climate change. Green infrastructure has been recognized as a critical strategy in climate change adaptation (e.g., reduce heat and floods) as well as climate change mitigation (e.g., carbon sequestration) (Demuzere et al. 2014). However, the issue of equity in planning is overlooked in green infrastructure planning under the consideration of climate justice in which the decisions should be made to take into account for the well-being of the most vulnerable population.

Several efforts are made to develop environmental justice indices, most prominently the newly released Environmental Justice Screening and Mapping Tool (EJSCREEN) (USEPA 2015). Such indices have tended to include measures of potential environmental exposures at the census tract level using available environmental hazardous sources for air pollution (e.g., PM<sub>2.5</sub>) and toxic or contaminated sites (e.g., USEPA Toxic Release Inventory site). However, no index to-date has taken into account the anticipated impacts of climate change on both local hydrology and populations. This paper proposes a climate justice assessment framework to incorporate social-

ecological vulnerability assessment in the green infrastructure planning process by first examining climate justice hotspots areas and then evaluating capacity of green infrastructure for climate change adaptation.

## **2 BACKGROUND**

Climate justice research applies an environmental justice framework to examine the racial and socioeconomic disparities in people's livelihood affected by climate change. In the past decades, environmental justice research has found strong relationship between environmental quality and socioeconomic indicators such as the influence of minority race (e.g., African Americans) on siting of toxic and waste facilities (Saha & Mohai 2005). For example, the metro Detroit areas have long been the environmental injustice hot spots—the air pollution has posed threats to the health and academic performance of the 3rd to 8th grade students in public schools (Mohai et al. 2011). Recent research has studied inequity of burdens from climate change associated environmental hazards among socioeconomic groups in local contexts, such as flooding hazards in Boston metropolitan area (Cheng, 2013), droughts (Smit & Pilifosova 2006), and urban heats (Mitchell & Chakraborty, 2014). As vulnerability and adaptive capacity vary from region to region and community to community, more studies on local-based climate justice are needed.

Green infrastructure serves multiple ecosystem services (Hansen & Pauleit, 2014); therefore, even if failed reaching climate policy goals, other benefits provided by the green infrastructure remain a win-win investment for society and thus has been identified as no-regrets climate change strategies. Both cities of Ann Arbor (2012) and Ypsilanti (2012) have developed climate action plans with primary focuses on climate change mitigation strategies for greenhouse gas reduction and implement green infrastructure as 'no regrets' strategies (Mees & Driessen 2011). In addition, the Huron River Watershed Council (HRWC) has assisted their watershed

communities to develop “community resilient” plans to address water resources management such as dam operations, water infrastructure, and in-stream flows considering climate change impacts. However, equity goals were silent in local climate change and the concept of adaptation was only a definition provided without any supporting measures or vulnerability assessment. The issue of a lack of equity planning is reflected on a recent national study on policy-making in climate change mitigation and adaptation plans that have failed to include social justice goals and make equity as an outcome compatible with environmental and economic goals of sustainability (Schrock et al. 2015).

To fill the gap of equity planning, this paper explores the evidence of climate justice through social-ecological vulnerability assessment and evaluates access to green infrastructure for climate change adaptation. This study aims to answer the following questions: 1) to what degree are the climate change-induced and associated environmental hazards spatially correlated with the socially vulnerable groups? 2) to what extent are green infrastructure available for climate change adaptation? This study applied the climate justice research framework to the Huron River watershed as a case study to assist further decision-making on prioritizing green infrastructure planning for climate change adaptation actions in watershed communities.

### **3 STUDY AREA**

The Huron River watershed drains an area of more than 2,300 km<sup>2</sup> and intersects seven counties in southeast of Michigan, including partial of the Oakland and Wayne counties that border the core of the metro Detroit area due east. The watershed contains a population about 500,000 residents across 65 municipalities, including major cities such as Ann Arbor and Ypsilanti along the lower basin of the mainstream.



## **4 METHODS**

A social-ecological climate justice assessment framework integrating climate change impacts on freshwater resources (i.e., flooding and associated environmental hazards) and environmental justice developed in this study included 1) a climate sensitivity study for the understanding of the extent of impacts from climate conditions (i.e., temperature and precipitation change) of the watershed; 2) Climate Justice Index through synthesizing flooding, environmental hazards, and social vulnerability indices; 3) a Green Infrastructure Index indicating the amount of available green infrastructure areas for climate change adaptation; 4) spatial analyses to examine potential hotspots of climate justice.

### **4.1 Climate sensitivity study**

The FHI was created based on a Climate Sensitivity Study conducted for the understanding of the extent of the impacts on the flooding hazards from changing temperature (0, +1, +2, +3, +4, +5°C) and precipitation (0, ±10, ±20%). A total of 30 climate conditions in 55-year simulation were applied to a hydrologic model—Soil and Water Assessment Tool (SWAT) model with 3-year warm-up. The detailed methodology of using SWAT for climate sensitivity study can be found in a separate paper (Cheng, 2013) and the calibration and validation of the SWAT model for this study is described in another paper (Xin et al. in development).

### **4.2. Climate Justice Index**

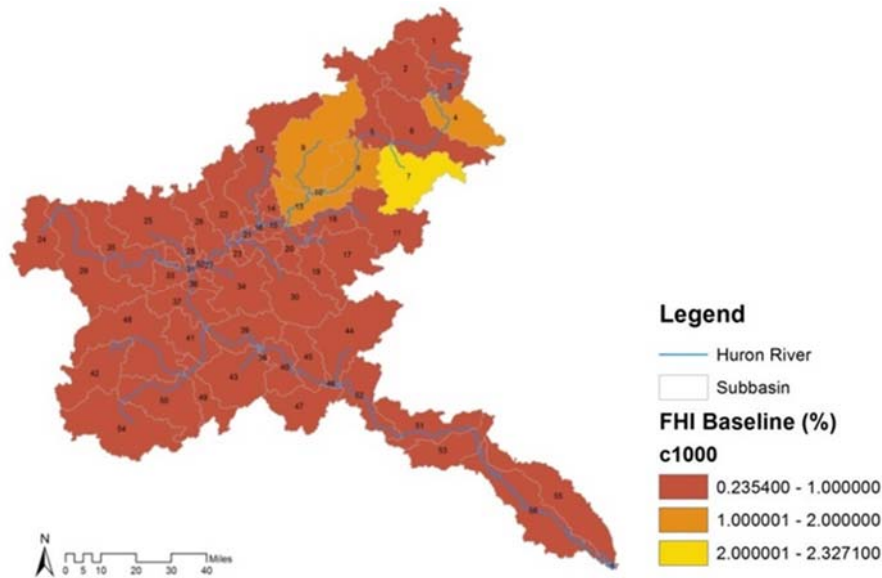
#### **4.2.1. Climate Change-Induced Flooding Hazard Index (FHI)**

Flooding hazard in this study is defined as a probability of daily stream flow higher than the bankfull discharge in a long period of time (i.e., 52 years that equal to 18,993 days in this study) as following:

$$\text{FHI} = P(Q > Q_{\text{bankfull}}) = (\text{Days when } Q > Q_{\text{bankfull}}) / (18,993 \text{ days})$$

Q: stream flow (SWAT output)

Qbankfull: stream bankfull volume (calculated 2-year return period)



**Figure 1. Baseline flooding hazard index (FHI) numbered by subbasin units**

Comparing to the baseline condition (Figure 1) at zero temperature and zero precipitation changes, increased Flooding Hazard Index (FHI) under any of the climate conditions is considered “Climate Change-Induced” flooding hazards. The climate change-induced FHI used for climate justice assessment is constructed based on the subtraction of FHI value in any given climate change scenario from the baseline FHI and categorized into a five-point scale (0: zero increase; 1: +0-1%, 2: +1-2%, 3: +2-3%, 4: +3-4%, 5: >+4%).

#### **4.2.2. Environmental Hazard Index (EHI)**

The EHI is taking water quality associated with environmental hazard sources into consideration. The environmental hazardous sites are point locations that include US EPA Toxic Release Inventory (TRI) facilities, National Priority List superfund sites, and Hazardous Waste-Treatment, Storage & Disposal (TSD) sites, as well as State of Michigan brownfield sites, leaking underground storage tanks, oil and gas wells, formally used defense sites, and landfills (Table 1).

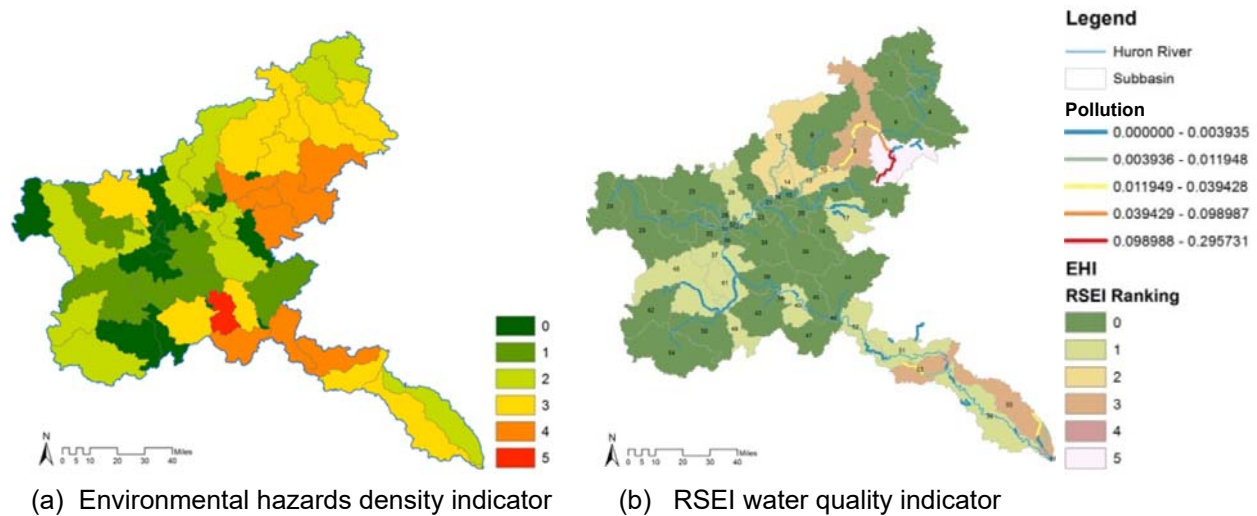
There were no landfill sites recorded within the study area and a total number of 1,385 hazardous sites were applied in this study. In addition to the point location of water pollution source, the US EPA Risk Screening Environmental Indicators (RSEI) water quality model for the year of 2010 was collected and analyzed.

**Table 1. List of environmental hazardous sites collected for this study**

Hazard Names	Description	Source	# sites in HRW	% HRW in MI	Notes
<b>TRI facilities</b>	Facilities that release hazardous air & water emissions	US EPA 2010	37	4.9	Multiple IDs occur in one location. Only sites with unique locations are counted.
<b>Superfund sites</b>	National Priority List	US EPA	3	4.5	66 NPL sites in Michigan, updated in May 2015
<b>Landfill</b>	Landfills (part 115 accepting active)	MDEQ	0	0.0	Michigan Department of Environmental Quality
<b>Hazardous waste</b>	Hazardous Waste - Treatment, Storage & Disposal (TSD)	US EPA	13	10.2	
<b>Brownfield sites</b>	Section 20112a	MDEQ	236	4.3	Part 201 inventory list
<b>LUST</b>	Part 213 Leaking Underground Storage Tanks	MDEQ	703	4.3	Corrective actions have not been taken. Include only leaking storage tanks that are either active or closed
<b>Oil and Gas wells</b>	Surface wells	private data	389	0.7	
<b>Formally Used Defense Sites</b>	Formally used defense sites	US Army Corp of Engineers	4	6.6	Multiple IDs occur in one location. Only sites with unique locations are counted.
<b>RSEI Polluted Stream Reach</b>	TRI point source pollution at reach level	US EPA RSEI Microdata 2010; USGS NHD reach	258 RSEI HRW reach	7.0 RSEI/ NHD	Detailed methodology for water pollution simulation refers to US EPA RSEI Model

The EHI was then synthesized through those two indicators: 1) the density of the number of the environmental hazardous sites calculated by the numbers of environmental hazard sites (excluding TRI facilities as they are included in the RSEI modeling) per square kilometers at sub-basin unit and categorized by natural break in a five-point scale, 0 being no non-TRI hazard source present (Figure 2a) the RSEI data of water pollution level from TRI facilities illustrating the total

pollution concentration for each stream reach. Each subbasin was ranked with a five-point scale based on natural breaks of water pollution concentration level and 0 indicates no pollution concentration was present (Figure 2b).



**Figure 2. (a) Density of the number of environmental hazard sites (excluding Toxic Release Inventory (TRI) facilities) at each subbasin illustrated in five-point scale based on natural breaks, 0 being no sites present (b) US EPA Risk Screening Environmental Indicators (RSEI) based on TRI facilities illustrating total pollution concentration at each stream reach and ranking at the subbasin with a five-point scale based on natural breaks, 0 being no pollution present.**

The concept of the EHI assumed all environmental hazard sites are susceptible to direct and indirect source for both surface and underground water pollution in each hydrologic subbasin unit. The formula for synthesizing the two indicators above based on a five-point scale is as following:

$$\text{EHI} = \text{Density} + \text{RSEI} \text{ (19 subbasins affected by TRI impacts)}$$

$$\text{EHI}=1 \text{ if Density}=0 \text{ and RSEI}=1 \text{ (subbasins 26, 37, 49);}$$

$$\text{EHI}=2 \text{ if Density}=0 \text{ and RSEI}=2 \text{ and above (subbasin 10);}$$

$$\text{If Density}>0, \text{ RSEI}=1, \text{ EHI}=\text{Density}+0 \text{ (subbasins 17, 40, 48, 51, 52, 56);}$$

$$\text{if Density}>0, \text{ RSEI}>1, \text{ EHI}=\text{Density}+1 \text{ (subbasins 5, 7, 8, 12, 13, 14, 53, 55);}$$

$$\text{if TRI over 33\% of total number of hazard sites, add 1 (subbasin 41)}$$

#### 4.2.3. Social Vulnerability Index (SoVI)

Socially vulnerable groups can be characterized based on demographic characteristics, socioeconomic indicators, access to medical and social welfare, housing density, and occupations that depend heavily on natural resources (Cutter et al., 2003). Social Vulnerability Index (SoVI) is a benchmark for measuring vulnerability in a systematic and quantitative approach. It has been used successfully in several national and regional social vulnerability studies and significant trends across temporal and spatial distributions were found in the United States (Cutter et al., 2003; Cutter & Finch, 2008; Borden et al., 2007). There are 33 socio-economic indicators identified in 220 census tracts in the Huron River watershed, including population who are female, children, the elderly, minority race, migrants, large families, renters, low-income and people who are below poverty level, people who are unemployed, people who employ in service and agricultural related jobs, people who have limited access to hospital and medical services, people who are receiving social benefits and medical cares, and people who live in urban areas (Table 2). Census data was from the US Census Bureau's American Community Survey 2013. Hospital data was from Southeast Michigan Council of Governments (SMCOG) in 2015.

**Table 2. Social vulnerability variables descriptive statistics (N=220)**

Variable	Variable Descriptions	Min.	Max.	Mean	S.D.	Variance
MEDAGE	Median Age	16.50	53.40	39.14	6.89	47.41
QBLACK	Percent African American	0.00	68.27	8.09	12.53	156.94
QNAMER	Percent Native American	0.00	1.99	0.24	0.40	0.16
QASIAN	Percent Asian and Hawaiian Islanders	0.00	42.59	4.80	7.44	55.30
QSPANISH	Percent Hispanic	0.00	14.90	3.33	2.72	7.42
QPISLAND	Percent pacific islanders	0.00	2.39	0.03	0.18	0.03

QKIDS	Percent of population under 5 yrs old	0.00	17.20	5.46	2.67	7.13
QPOP65O	Percent of population 65 and over	0.00	36.70	11.91	5.60	31.35
PPUNIT	Average number of people per household	1.51	4.46	2.55	0.41	0.17
QRENTER	Percent renter occupied housing units	0.80	100.00	27.73	26.96	726.82
NRRESPC	Per capita residents in nursing homes	0.00	7.52	0.23	0.89	0.79
QFEMALE	Percent female population	36.50	79.30	50.79	3.91	15.33
QFHH	Percent female headed households, no spouse present	0.00	35.10	9.67	5.84	34.06
HOSPTPC	Per capita number of community hospitals	0.00E+00	1.02E-03	3.41E-04	1.91E-04	0.00E+00
HODENT	Number of housing units per square mile	12.18	6645.43	904.62	1103.54	1.22E+06
PERCAP	Per Capita Income (in 2013 dollars)	10,141.00	85,173.00	33,187.75	10,510.54	1.10E+08
MHSEVAL	Mean Value of Owner Occupied Housing Units	16,600.00	644,700.00	191,135.89	91,131.93	8.31E+09
M_C_RENT	Mean Contract Rent	338.00	1923.00	851.05	281.21	7.91E+04
PHYSICN	Number persons per 100,000 population employed as healthcare practitioners and technical occupations	0.00	19,524.96	6,809.51	3,371.80	1.14E+07
MIGRA	Percent Foreign Born Citizens Immigrating between 1990 and 2000	0.00	48.50	5.49	8.87	78.66
QCVLUN	Percent civilian unemployment	0.00	40.50	9.51	4.77	22.72

QRICH	Percent of households earning \$100,000 or more	0.00	78.77	29.68	15.98	255.46
QPOVTY	Percent living below poverty level	0.30	69.00	11.69	11.62	135.03
QMOBIL	Percent of housing units that are mobile homes	0.00	75.80	5.29	11.46	131.40
QED12LES	Percent of population 25 years or older with no high school diploma	0.00	31.50	6.76	4.58	20.98
QCVLBR	Percent of population participating in the labor force	33.29	75.07	53.80	6.31	39.81
QFEMPLBR	Percent females participating in the labor force	33.10	100.00	62.71	8.55	73.14
QAGRI	Percent employment in farming, fishing, and forestry occupations	0.00	5.40	0.41	0.86	0.74
QTRAN	Percent employed in transportation, communications, and other public utilities	0.00	17.10	3.76	3.30	10.92
QSERV	Percent Employed in service industry	0.00	44.90	16.11	7.03	49.47
QHCSERV	Percent civilian employed population 16 years and over - Educational services, and health care and social assistance	0.00	74.50	28.60	12.07	145.65
QURBAN	Percent urban population	0.00	100.00	84.54	28.85	832.05
QSSBEN	Percent of population collecting social security benefits	0.00	70.83	26.40	9.60	92.13

---

SoVI is constructed through a series of statistical methodology: normalization, standardized, principal component analysis using a varimax rotation and Kaiser criterion for component selection, Pearson's correlation between components, and synthesizing components through respective positive or negative impacts on vulnerability. Table 3 summarized the results of the principal component analysis and each component's propensity to social vulnerability.

**Table 3. Huron River watershed Social Vulnerability Index (SoVI) variables principal component analyses results**

Component	Component Cardinality (+: increase; -: decrease;  : neutral)	Vulnerability concepts	% Variance explained	Accumulative % Variance explained	Dominant variables	Component Loading
1	(+)	Occupation	18.77	18.77	QSEV QED12LES QCVLUN QFHH QPOVTY QBLACK M_C_RENT PHYSICN MHSEVAL QRICH PERCAP QHCSEV QRENT QASIAN QPOVTY HODENT MIGRA MEDAGE QPOP65O QSSBEN	0.79 0.77 0.69 0.62 0.56 0.51 -0.58 -0.61 -0.72 -0.80 -0.86 0.78 0.77 0.72 0.69 0.69 0.67 -0.62 0.87 0.65
2	(+)	Health resources	14.13	32.90		
3	(+)	Age	8.20	41.10		



					MEDAGE	0.54
					PPUNIT	-0.60
4	(-)	Employment	7.92	49.02	QCVLBR	-0.90
					QFEMPLBR	-0.82
5	(+)	Children	6.08	55.10	QKIDS	0.79
		Race-Black			QBLACK	0.53
6	(+)	Urban	5.61	60.71	QURBAN	0.85
					QAGRI	-0.80
7	(+)	Women	4.01	64.71	QFEMALE	-0.68
		Race-Native American			QNAMER	0.64
8	(+)	Mobile structure	3.98	68.70	QMOBIL	-0.73
9	(+)	Race-Pacific Islanders	3.95	72.65	QPISLAND	0.89

#### 4.2.4. Climate Justice Index (CJI)

Climate Justice Index (CJI) is designated to identify places where socially vulnerable people are likely to suffer most from the climate change impacts. CJI is the synthesis of the three indices—FHI, EHI, and SoVI—using their calculated mean in a five-point scale at census tract level. FHI and EHI were converted from the sub-watershed unit to the census tract unit based on area weighted method respectively.

#### 4.3. Green Infrastructure Index (GII)

This study identifies green infrastructure as natural and man-made open space that has potential to serve as stormwater management and flood mitigation tools. Based on the most recent 2010 land use data provided by the Southeast Michigan Council of Governments (SEMCOG), green infrastructure includes agriculture, recreation, golf course, cemetery, park and open space, and water areas. The total green infrastructure land use areas occupy 25.5% watershed area whereas the rest of the land uses are considered as built areas that include residential, industrial, transportation, office, retail, medical, parking and vacant land uses. The Green Infrastructure Index

(GII) is constructed based on hydrological connectivity of the green infrastructure in respective subbasin unit, then transformed into census tract unit comparable with Climate Justice Index (CJI) for further planning implications under political jurisdiction decision-making. Several steps were taken for building the GII: 1) calculate the fraction of green infrastructure area in each subbasin area, 2) calculate the fraction of each intersected subbasin area within the census tract unit area, 3) convert subbasin unit to census tract unit through summing the multiplied fractions from steps one and two, 4) create an index in a five-point scale based on the natural break of the values calculated in step three; one being the least and five being the most scores in census tract unit.

#### **4.4. Statistical and spatial analyses**

IBM SPSS version 21 was used for constructing SoVI and performing descriptive analysis and Pearson's correlation. The Getis-Ord Gi Hot Spot Analysis in spatial statistics of ESRI ArcGIS 10.1 was applied for analyzing spatial distribution of one variable such as the composite CJI. ArcGIS 10.1 was also used for mapping. Finally, bivariate cluster analysis for analyzing spatial distribution pattern between two variables (i.e., SoVI, EHI) was conducted using the GeoDa system developed by the Arizona State University GeoDa Center.

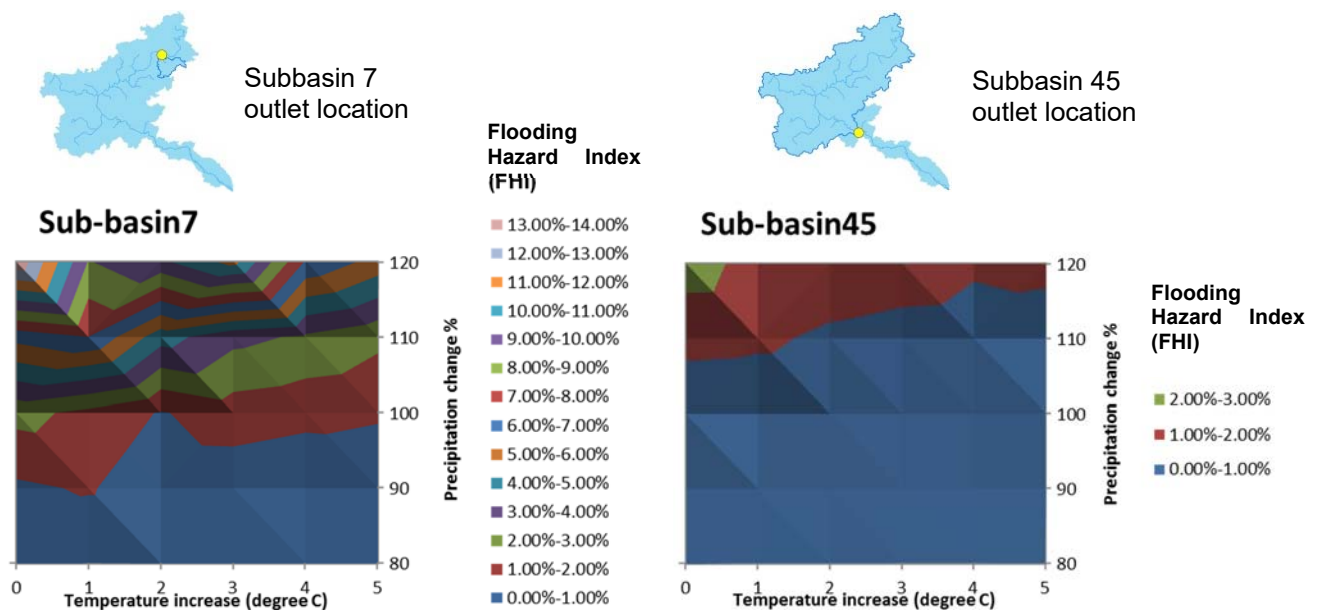
### **5. RESULTS**

#### **5.1. Climate change-induced flooding hazards**

Climate sensitivity study revealed a wide range of sensitivity to climate change shown in measures of flooding hazard index (FHI) among 30 climate conditions and 57 subbasins. For example, subbasin 7 demonstrates the highest sensitivity to climate change at a wide range of 13.8% comparing to subbasin 45 at a range of 2.5% (Figure 3). The average of all climate sensitivity results is 0.7% (n=1710). In a general trend, increasing temperature will decrease FHI while increasing precipitation will increase FHI in the Huron River watershed. Among 57

subbasins, the average FHI is 0.55% with a minimum of 0.24% and a maximum of 2.33% (subbasin 7). The upper stream is sensitive to climate change-induced flooding hazards, and the climate change impacts expand predominately along the main channel with a few first-order stream reach subbasins at the higher climate change impact conditions.

Based on the results of climate sensitivity study, two climate change impact scenarios are identified in this study for further demonstration: one with lower climate change impacts at the climate condition of 2°C increase in mean temperature and 10% increase in mean precipitation; the other with higher climate change impacts at the climate condition of 1°C increase in temperature and 20% increase in precipitation.

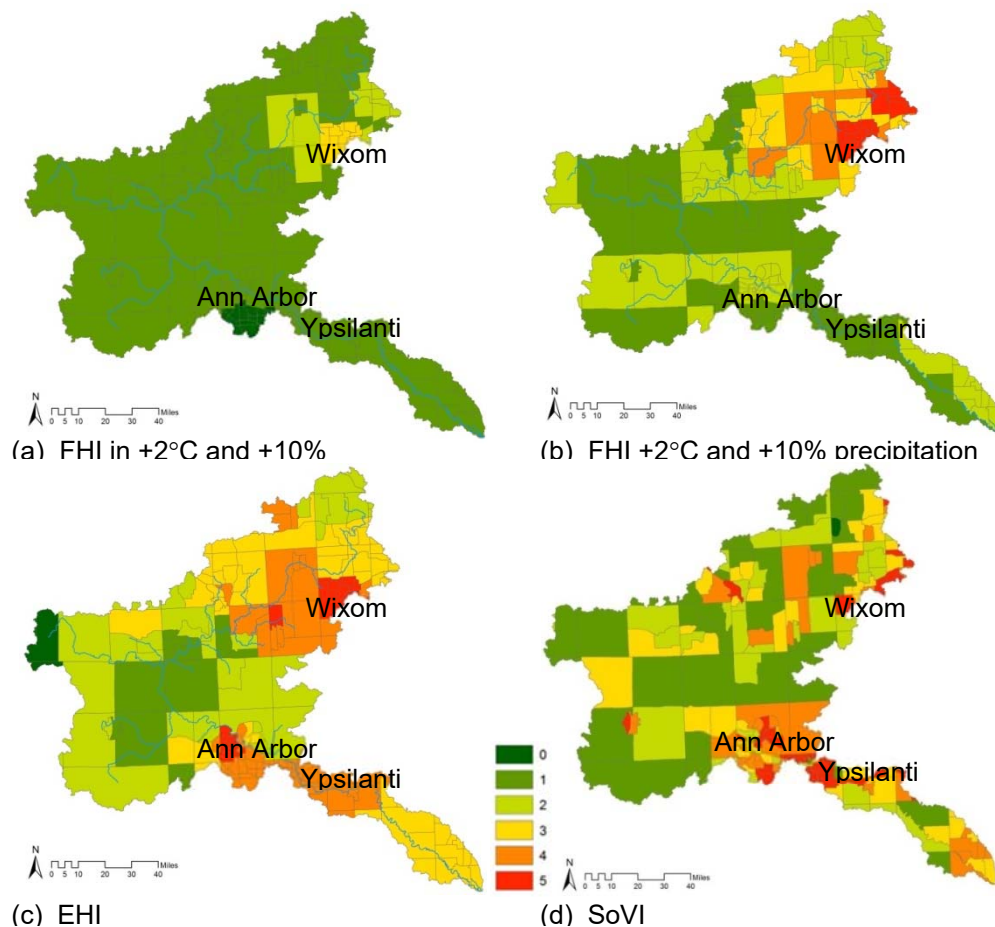


**Figure 3.** Climate sensitivity study shows varied response to 30 climate conditions reflecting on the flooding hazard index (FHI). For example, subbasin 7 with a range of 14 percent change in FHI shows a higher sensitivity to climate change impacts than subbasin 45 with a range of 3%. In general, increasing temperature change reduces FHI while increasing precipitation increases FHI.

## 5.2. Climate Justice Index

Climate Justice Index (CJI) is a synthesis of the FHI, EHI, and SoVI indices. Figure 4 illustrates the results of the three indices before being synthesized into one single CJI. The cities

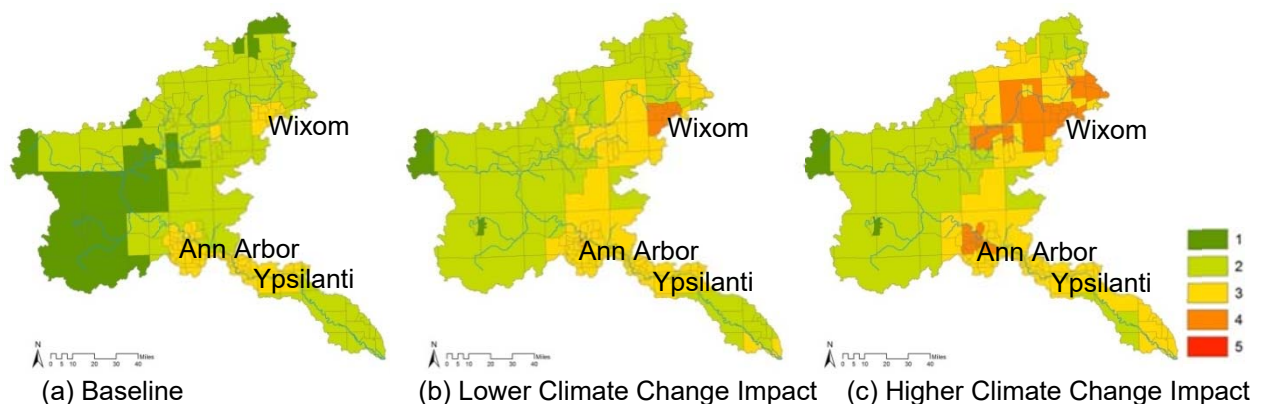
of Wixom, Ann Arbor, and Ypsilanti are prone to climate change-induced flooding hazards; the impacts of climate change on increased probability of flooding hazards are larger in the higher climate change impact scenario comparing the lower impact scenario (Figure 4a and 4b). The results of EHI illustrate the high potential for climate change associated water pollution (EHI=4 or 5), are surrounding cities of Wixom, Ann Arbor, and Ypsilanti (Figure 4c). The SoVI illustrates a relative high level of social vulnerability also occur near urban areas of Wixom, Ann Arbor, and Ypsilanti (Figure 4d).



**Figure 4. Individual indices before synthesized into climate justice index highlight the cities of Wixom, Ann Arbor, and Ypsilanti in high alerts. (a) lower and (b) higher climate change impacts scenarios for Climate Change-Induced Flooding Hazard Index (FHI) illustrate increased flooding probability differences from baseline, 0: zero increase, 1: +0-1%, 2: +1-2%, 3: +2-3%, 4: +3-4%, 5: >+4%; (c) Environmental Hazard Index (EHI) synthesized density of the number of environmental hazardous sites and total pollution concentration in subbasin unit and converted to census tract unit with a five-**

point scale based on natural breaks, 0 being no pollution source present; (d) Social Vulnerability Index (SoVI) is shown in quintile with a five-point scale: 5 being the top 20% social vulnerability, 0 being no data present.

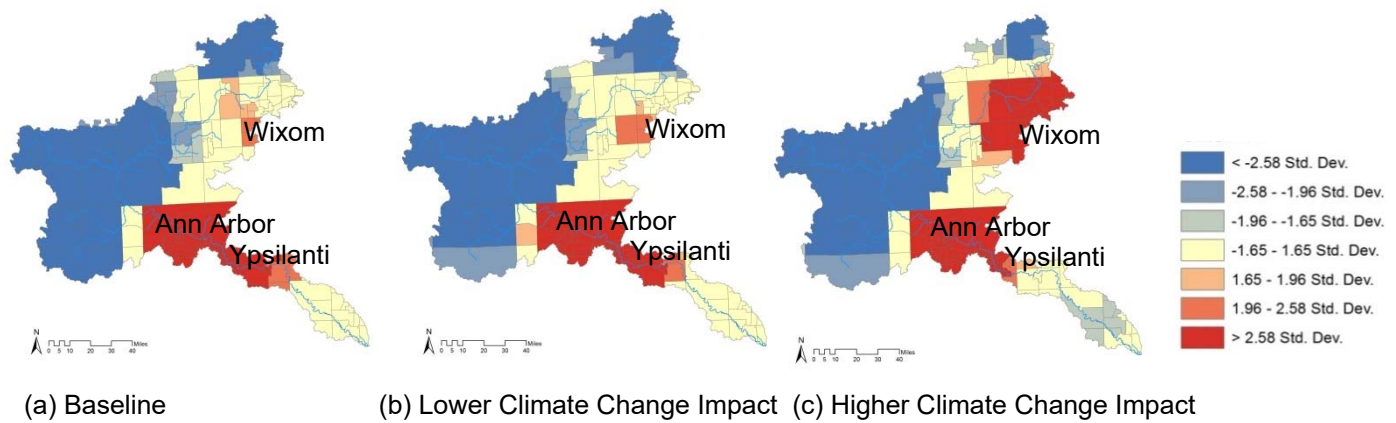
Figure 5 illustrates the synthesized CJI comparing between the baseline condition at zero flooding increase in current climate condition with lower and higher impact of climate change scenarios. The results demonstrate that the cities of Wixom, Ann Arbor, and Ypsilanti are areas likely facing the climate injustice issue (CJI=3) in baseline condition when no climate change condition occur and zero increase in the probability of climate change-induced flooding (Figure 5a). When facing climate change impacts of increased flooding hazards, the Wixom area is highly susceptible to climate injustice (CJI=4) even under the lower climate change impacts (Figure 5b). In higher climate change impacts scenario, more census tracts with higher socially vulnerability around Wixom and Ann Arbor areas would face more challenges of the climate change-induced environmental hazards and consequently encounter higher level of climate injustice (CJI=4) (Figure 5c).



**Figure 5. Synthesized Climate Justice Index in a five-point scale, 1 indicates the least and 5 indicates the most potential for climate injustice implications in (a) baseline, (b) lower climate change impact, and (c) higher climate change impact scenarios**

To further analyze spatial distribution of climate justice issues, Figure 6 demonstrates the results of Hot Spot Analysis of the baseline condition comparing to the lower and higher climate

change impact scenarios. The red census tracts represent census tracts with higher CJI rankings that tend to be clustered together whereas the blue ones represent lower CJI clusters. Cities of Ann Arbor and Ypsilanti are two significant climate injustice areas from the baseline condition (Figure 6a). Comparing between the lower and the higher climate change impacts scenarios, the cluster of high CJI in Wixom area enlarged significantly, implying high sensitivity to the change of climate conditions in those area (Figure 6b and 6c).

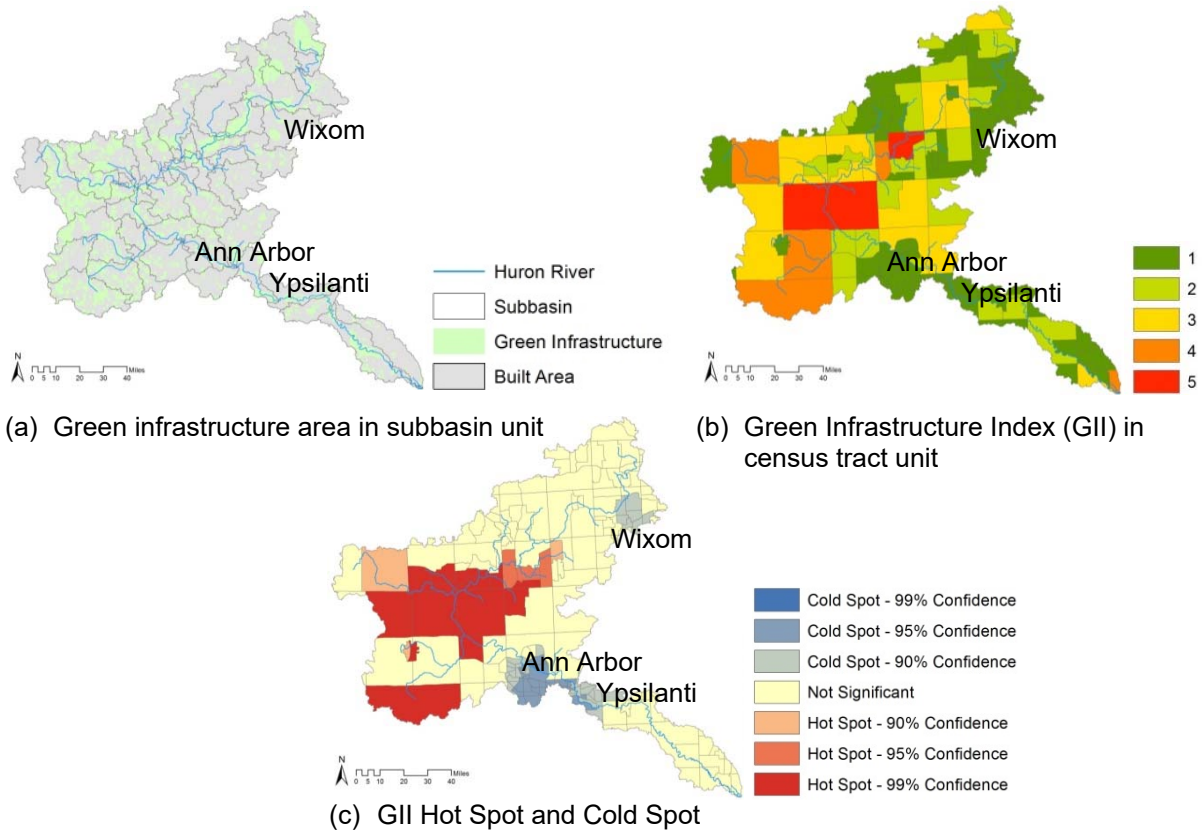


**Figure 6. Spatial analyses illustrating Climate Justice Index hotspots in red comparing among (a) baseline, (b) lower climate change impact, and (c) higher climate change impact scenarios**

### 5.3. Green Infrastructure Index (GII)

This study focuses on the hydrological connectivity of the green infrastructure for mitigating climate change-induced flooding hazards and water pollution, which also serves to improve adaptive capacity for socially vulnerable communities. Most green infrastructure land use areas concentrate in subbasins in the middle stream on the west side of the watershed. The cities of Wixom, Ann Arbor, and Ypsilanti are in subbasins with lower amount of green infrastructure (Figure 7a). The Green Infrastructure Index (GII) shown in census tract units highlighted the same spatial patterns of the distribution of green infrastructure land use areas where green color indicates the least amount of hydrologically connected green infrastructure and red indicates the most

availability of green infrastructure (Figure 7b). The hot spot analysis further confirmed the spatial distribution of clustered GII in high ranking on the west side of the watershed and the cold spots for low ranking of GII around cities of Wixom, Ann Arbor, and Ypsilanti (Figure 7c).



**Figure 7. (a) green infrastructure land use areas distribution in subbasin unit; (b) Green Infrastructure Index (GII) in census tract unit is derived from weighted green infrastructure area in proportion to subbasin area and illustrated based on natural break of the distribution; 1 indicates the least and 5 indicates the most amount of hydrologically connected green infrastructure; (c) GII Hot Spot and Cold Spot analysis illustrates census tracts with high GII are spatially clustered on the west and low GII are clustered around cities of Wixom, Ann Arbor, and Ypsilanti.**

#### 5.4. CJI and GII Spatial relationship

To further examine the spatial relationship between the CJI and GII, the results of bivariate Moran's I testing suggest a significant negative effect (Moran's  $I = -0.4327$ ) (Figure 8). Census tracts with a high CJI tend to be clustered with low GII. This finding indicates that currently areas

with high level of climate injustice are happen to be where the low level of green infrastructure availability are.

**Figure 8. Results of spatial statistics (bivariate Moran's I test) between CJI in higher climate change impact scenario and GII suggest a significant negative cluster pattern where high CJI are clustered with low GII**

## 6. DISCUSSIONS

This study applied a Climate Justice Assessment framework incorporating social-ecological vulnerability assessment under climate change impacts scenarios and revealed empirical evidence of Climate Justice concerns particularly around cities of Wixom, Ann Arbor, and Ypsilanti in the Huron River watershed. In particular, under the higher climate change impact conditions, climate change-induced flooding hazards become more prominent in the Wixom area along with a higher level of potential water pollution from environmental hazardous sites. Those areas in higher environmental vulnerability are also the areas where more socially vulnerable groups reside. Nevertheless, the Climate Justice Index hot spots match where the Green Infrastructure Index cold spots are, indicating that the potential biophysical capacity of green infrastructure (Matthews et al. 2015) for climate change adaptation in the Cities of Wixom, Ann Arbor, and Ypsilanti are currently at a minimum.

In recent years, the Cities of Ann Arbor (2012) and Ypsilanti (2012) have developed their *Climate Action Plans* and indicate green infrastructure as one of the no-regret strategies. In addition, the Huron River Watershed Council (HRWC) has assisted watershed communities, including Ann Arbor-Ypsilanti areas, for building resiliency through the understanding of potential climate change impacts on the watershed management systems as well as outlining strategies in coping with climate change. Therefore, currently the Ann Arbor-Ypsilanti area has the social-political



feasibility to increase the green infrastructure capacity for climate change adaptation (Matthews et al. 2015) and with a great potential to address climate justice issue in green infrastructure planning process.

On the other hand, the City of Wixom has not yet making plans for climate change and efforts are undertaken by the HRWC to assist in that area. Therefore, currently the Wixom area has both low biophysical and social-political feasibility to increase green infrastructure capacity for climate change adaptation and leaving Wixom as the highest climate injustice areas under the impacts of climate change in the entire watershed area.

## **7. CONCLUSIONS**

This study has demonstrated empirical evidence of a lack of green infrastructure capacity to address climate justice of potential impacts from climate change-induced flooding and water quality impairment under changes of climate conditions in Cities of Wixom, Ann Arbor, and Ypsilanti in the Huron River watershed. This place-based climate justice assessment framework combined with biophysical and social-political feasibility assessment of green infrastructure capacity for climate change adaptation can be applied in other watersheds. The results of climate justice hotspots under a range of climate change conditions could inform decision-making in community planning to prioritize green infrastructure resources in areas with the greatest social needs for climate change adaptation actions.

## **REFERENCES**

- Borden, K. A., Schmidtlein, M. C., Emrich, C. T., Piegorsch, W. W., & Cutter, S. L. (2007). Vulnerability of U.S. cities to environmental hazards. *Journal of Homeland Security and Emergency Management*, 4(2).
- Cheng, C. (2013). *Social vulnerability, green infrastructure, urbanization and climate change-induced flooding: A risk assessment for the Charles River watershed, Massachusetts, USA*. Dissertation. University of Massachusetts, Amherst.
- City of Ann Arbor (2012). *Climate Action Plan*. City of Ann Arbor.
- City of Ypsilanti (2012). *Climate Action Plan*. City of Ypsilanti.
- Cutter, S. L., Boruff, B. J., & Shirley, W. (2003). Social vulnerability to environmental hazards. *Social Science Quarterly (Blackwell Publishing Limited)*, 84(2), 242-261.
- Cutter, S. L., & Finch, C. (2008). Temporal and spatial changes in social vulnerability to natural hazards. *Proceedings of the National Academy of Sciences of the United States of America*, 105(7), 2301-2306.
- Demuzere, M., Orru, K., Heidrich, O., Olazabal, E., Geneletti, D., Orru, H., Bhawe, A. G., Mittal, N., Feliu, E., & Faehnle, M. (2014). Mitigating and adapting to climate change: Multi-functional and multi-scale assessment of green urban infrastructure. *Journal of Environmental Management*, 146(0), 107-115. doi: 10.1016/j.jenvman.2014.07.025
- Hansen, R., & Pauleit, S. (2014). From Multifunctionality to Multiple Ecosystem Services? A Conceptual Framework for Multifunctionality in Green Infrastructure Planning for Urban Areas. *AMBIO*, 43(4), 516-529. doi: 10.1007/s13280-014-0510-2
- Huron River Watershed Council. *Climate-Resilient Communities*, Retrieved December 12, 2015 <http://www.hrwc.org/our-work/programs/making-climate-resilient-communities/>

- IPCC. (2014). Summary for Policymakers. In C. B. Field, V. R. Barros, D. J. Dokken, K. J. Mach, M. D. Mastrandrea, T. E. Bilir, M. Chatterjee, K. L. Ebi, Y. O. Estrada, R. C. Genova, B. Girma, E. S. Kissel, A. N. Levy, S. MacCracken, P. R. Mastrandrea & L. L. White (Eds.), *Climate Change 2014: Impacts, Adaptation, and Vulnerability. Part A: Global and Sectoral Aspects*. Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change (pp. 1-32). Cambridge, United Kingdom, and New York, NY, USA: Cambridge University Press.
- Matthews, T., Lo, A. Y., & Byrne, J. A. (2015). Reconceptualizing green infrastructure for climate change adaptation: Barriers to adoption and drivers for uptake by spatial planners. *Landscape and Urban Planning*, 138, 155-163. doi: 10.1016/j.landurbplan.2015.02.010
- Mees, H.-L. P., & Driessen, P. P. J. (2011). Adaptation to climate change in urban areas: Climate-greening London, Rotterdam, and Toronto. *Climate Law*, 2(2), 251-280. doi: 10.3233/CL-2011-036
- Mitchell, B. C., & Chakraborty, J. (2014). Urban Heat and Climate Justice: A Landscape of Thermal Inequity in Pinellas County, Florida. *Geographical Review*, 104(4), 459-480. doi: 10.1111/j.1931-0846.2014.12039.x
- Mohai, P., Kweon, B.-S., Lee, S., & Kerry, A. (2011). Air Pollution Around Schools Is Linked To Poorer Student Health And Academic Performance. *Health Affairs*, 30(5).
- Saha, R., & Mohai, P. (2005). Historical context and hazardous waste facility siting: Understanding temporal patterns in Michigan. *Social Problems*, 52(4), 618-648. doi: 10.1525/sp.2005.52.4.618

- Schrock, G., Bassett, E. M., & Green, J. (2015). Pursuing Equity and Justice in a Changing Climate: Assessing Equity in Local Climate and Sustainability Plans in U.S. Cities. *Journal of Planning Education and Research*, 35(3), 282-295. doi: 10.1177/0739456x15580022
- Smit, B., & Wandel, J. (2006). Adaptation, adaptive capacity and vulnerability. *Global Environmental Change*, 16(3), 282-292. doi: 10.1016/j.gloenvcha.2006.03.008
- USEPA. *EJSCREEN: Environmental Justice Screening and Mapping Tool*, Retrieved September 15, 2015, from <http://www.epa.gov/ejscreen>
- Walker, G., & Burningham, K. (2011). Flood risk, vulnerability and environmental justice: Evidence and evaluation of inequality in a UK context. *Critical Social Policy*, 31(2), 216-240. doi: 10.1177/0261018310396149

### **BIO--Chingwen Cheng**

Dr. Cheng is Assistant Professor of Landscape Architecture at the Arizona State University. She holds a PhD in Regional Planning from the University of Massachusetts Amherst and a MLA from the University of Michigan. She is licensed Professional Landscape Architect and LEED Accredited Professional with seven years of practices in the United States. Cheng is dedicated to engaging transdisciplinary research to advance resilience theory in design practices through investigating climate change impacts on urban water systems and social-ecological vulnerability and the role of green infrastructure to enhance resilience under the consideration of climate justice for long-term sustainability of communities.



COUNCIL OF EDUCATORS  
IN LANDSCAPE ARCHITECTURE

*A CELA Conference Presentation*

*Abstract ID: 308*

## **TURNING TO A LANDSCAPE OF CITIZENSHIP: THE CRITICAL EFFECTS OF INTRODUCING LANDSCAPE ARCHITECTURE TO THE CLEVELAND URBAN DESIGN COLLABORATIVE**

**FREDRICK, CHARLES**

Interim Director, MLA Program, Assistant Professor, Kent State University

**WILLOUGHBY, WILLIAM T.**

Associate Dean and Associate Professor, College of Architecture & Environmental Design, Kent State University

### **ABSTRACT**

*For over fifteen years, the Cleveland Urban Design Collaborative (CUDC) has been a practice-based educational model that has sought to solve civic problems urbanistically and address the challenges of shrinking and legacy cities in Northeast Ohio through landscape-based solutions.*

*With the introduction of a graduate landscape architecture program last year, communities calling on the CUDC now have an outlet for turning landscape problems, deemed relevant for students, into service-learning opportunities for exploring landscape architecture. With this change, the CUDC has expanded its mission through a stronger turn toward landscape. Reclamation of historic parks, consolidating vacant residential lots into something wholesome for the remaining community, addressing storm water management with green infrastructure, exploring freshwater issues facing lakefronts, proposing urban agriculture, and advocating for transportation alternatives like biking and paddling are among the contributions landscape architecture has brought to the CUDC.*

*Community partnerships play out in design studios, study tours, workshops, conversations with future partners, charrettes, and student-led practice opportunities—and altogether mean to make students into active citizens in their region. The program has tackled projects with a strong and direct bearing on community engagement and citizenship both in and beyond the design studio. This essay and accompanying presentation outlines the intellectual, social, and curricular changes taking place after a year of landscape architecture education at the CUDC.*

### **1.1 Keywords**

Cleveland Urban Design Collaborative (CUDC), community partnerships, community engagement

## 2 INTRODUCTION

"The function of the university is not simply to teach bread-winning . . . or to be a centre of polite society; it is, above all, to be the organ of that fine adjustment between real life and the growing knowledge of life, an adjustment which forms the secret of civilization."— Du Bois, W.E.B. (1903). Chapter V: Of the Wings of Atlanta. In *The Souls of Black Folk* (p. 16). Chicago, IL: A.C. McClurg & Co.

The changes in Northeast Ohio are both unprecedented and perplexing with an unclear sense of where to begin or what direction to take. The problems of piecemeal foreclosure, property abandonment, and vacancy; the slow and difficult switch from unionized manufacturing to a service-based economy; the messy environmental aftermath of industry and the legacy of brownfields, expensive building abatement, and contaminated waterways; and the overextended, poorly-maintained, crumbling, and outmoded civic infrastructure from the last century all point to an uncertain future for the region. New development and solving urban problems with more of the city are not answers to the situation in Northeast Ohio.

Instead, solutions seem to exist in enlisting community in the solution to these problems. In this context, a designer will not discover creative solutions in newness, originality, or purity. Instead, the region requires creative solutions best expressed in adaptive reuse, hybrid programs, repurposing, reclamation, demolition, and participatory design. The motive behind university-community endeavors should be to acculturate the design student into becoming an active member of the community. Communities can be collaborators in student learning and for the implementation of faculty expertise. This combination benefits the community by tackling projects that envision the future shape of the community—or, as in the case of design-build projects, to actually construct the community's future.

Places are as much physical situations as they are collections of historic decisions made by the populace. The decisions people make individually and in aggregate shape the city. Hence, the cities in this region can once again enfranchise the decisions of the people that live there. A participatory democracy thrives where constituent citizens are capable of improving not only themselves but their whole community. What this implies is that community folds together around the matter of landscape; and the landscape architect can serve as translator and rigorous definer of the contributions of all members of the community who would wish and will their places to change.

In these transformative times for Northeast Ohio, architects and urban designers lack the traditional tools to redefine places shrinking in population, spreading out or filling exurban enclaves, abandoning once valued properties, leaving behind brownfields, and the thinning out of blight-ridden property into a diffuse confederation of smaller civic places with land between.

The potential within the unevenly occupied and complexly layered "land between" holds the greatest possibility for a regional transformation of Northeast Ohio—and landscape architecture has the best professional handle for managing these changes. In essence, this could be Northeast Ohio's finest and most courageous hour—and the timing of Kent State University's new Landscape Architecture program to demonstrate responsible stewardship and partner-activism during this hour—to redefine the rules of engagement that underpin a professional education in landscape architecture and environmental design.

### **3    NORTHEAST OHIO**

Northeast Ohio is facing challenges that other places will either face in the coming years or have already faced during their cyclic history. Depopulation, shifting populations that have migrated to the suburbs and exurbs, sluggish but persistent economic transformation, and changing social demographics have all contributed to academics and community leaders using terms such as "shrinking cities" and "legacy cities." With matters that are perhaps too numerous to outline fully

here, it suffices for now to recognize—as cities depopulate, as pollution-producing industry evolves, and as the physical places obsolesce in their capacity to support current social and cultural activities—that Northeast Ohio holds within its grasp the great opportunity for landscape to take preeminence in the transformation of the region. As the city rolls up its carpet of buildings and factories, it reveals the landscape beneath. In other words, residential, commercial, and industrial vacancy all point to a return to and renewal of the land—in the form of restoration and reclamation, demolition and disposal, and the reintroduction of habitat.

Northeast Ohio is left with an inherited investment of 19th and early 20th century city planning, with public squares, monumental public buildings, former trolley lines, and streets lined with pedestrian-friendly storefronts. Housing in Northeast Ohio followed one of two patterns: the large multigenerational 19th century home and the Fordist model of balloon-framed, single-family, small lot housing—scaled for the early 20th century working and managerial classes. Later, this structure was overlaid with Eisenhower era automobile city systems that facilitated the shift to residential suburbs and the development of automobile-oriented shopping centers, industrial and business parks, and shopping malls. After amortizing and vacating many of its regional malls, the next generation of easily replicable suburban development now includes exurban lifestyle centers or big box retail centers—sometimes located on former industrial sites or in outlying edge cities.

The identity of Northeast Ohioans has been dealt a major turn of fortune over the last 40 years. The 100 year-long economic boom centered on industry and the associated investment in civic infrastructure that began in the 1870's lasted until the 1970's; leading afterwards into relatively drastic decline in manufacturing and industry. These shifts have led to a sense of loss and abandonment that galvanized into a cultural attitude fixated on the region's former glory. In other



words, a "once we were great" mentality has pervaded with the evolution and loss of large scale manufacturing in the region.

The thinning out of industries over the last 40 years has given way to the desire to remediate former sites and to clean up and address the decades of contamination by industry. Hard to manage problems persist in these legacy cities—so the reclamation of brownfields, the aging and neglected civic infrastructure, the combined sewer and stormwater management problems, the dwindling civic services, abandoned properties, and diminishing tax revenues—altogether abrogate the potential for positive change.

This combination of historic infrastructure, within a climactic region that feels the freeze-thaw cycles that swing from mild moist summers to generally long snowy and frigid winters—creating much damage and deterioration, while requiring just as much maintenance and repair to roads and transportation systems. The region is in the slow and involuntary shift from being a former heavy industry and manufacturing hub to a post-industrial, knowledge-based, and service-centered economy that is seeking to distinguish itself from its global competition.

In addition, many of the cities in Northeast Ohio are all entangled in the expensive, sporadic, and speckled demolition of its abandoned and foreclosed building stock; leading to a disconnected checkerboard of civic open space and a marked reduction in property tax collections that adversely affects maintenance and upkeep costs for cities that finding themselves financially hamstrung—unable to maintain services for their own citizenry, or make improvements with the declining revenue they collect.

Today however, use of the pejorative, "Rust Belt," has waned as other economic and social assets in the region have shifted into the fore. Higher education, healthcare, and resilient name-brand manufacturing and service-based companies are fortifying the region's economy. Leadership,

management, and research and development continue to thrive at the corporate headquarters of well known companies that still have national prominence and have become global corporations with strong international ties.

In a situation where a region is spreading and shrinking simultaneously there can be multiple landscape tactics put into play that can transform development. Potential for change exists in the region's picturesque riparian corridors, waterfalls and wetlands, its geological complexity, and its natural sylvan landscape—which are all latent assets to the region.

The shift in the cultural treatment of landscape is no different and no less transformative. These changes have been happening slowly but deliberately for decades. Small rivers were once dammed for powering the regions early manufacturing; larger rivers in the region became exploited assets to heavy industry and steel manufacturing. The short-lived Ohio-Erie canal and towpath that briefly traversed the State, and the subsequent network of railways and interurbans that once stitched the region together to surrounding states, have left a legacy of abandoned infrastructure ripe for repurposing. Lake Erie and its shore were once considered geographic attributes that could facilitate industry, allow for easy transport by ship, and shores that were once only good for the piling of solid waste from civic and industrial growth. Today's economic changes, coupled with greater regulation of local waterways has led to a desire to exploit the opportunities for recreation and private development in the region's former industrial landscapes and waterways.

### **3.1 DEFINING THE LANDSCAPE ARCHITECTURE PROGRAM**

The graduate program in Landscape Architecture was initiated with the strategy of developing an educational model defined by its regional setting. Out a desire to address the opportunities present in Northeast Ohio, and without a compelling legacy beyond location, the program seeks places that offer the possibility to participate with community partners in a regionally unique service-learning relationship. Five principles are guiding the program: establish

locale, explore opportunities, develop relationships, advance pedagogy, and facilitate program maturity through community bonds and cross-disciplinary collaborations.

What today is known as the College of Architecture and Environmental Design at Kent State University began in 1947 as a 2-year, pre-professional Architectural Drawing degree born out of a regional need for additional draftsmen in architectural offices and grew from there to become an accredited program in 1964. In 1999 the Cleveland Urban Design Collaborative (CUDC) established residence in Cleveland, superseding the mission of the Urban Design Center of Northeast Ohio which began in 1983. The College of Architecture and Environmental Design emerged from another college in 2004 after the Interior Design program accepted an invitation to join together with Architecture. In 2007, the Architectural Studies undergraduate program was created, and new graduate programs in Landscape Architecture, Health Care Design, and a research-based Master of Science in Architecture and Environmental Design were launched in 2014.

Landscape architecture had been a topic of conversation at Kent State University since the 1980's and groundwork began in the early 2000's. In 2010, growth of programs led many in the College to recognize that landscape architecture was as a missing allied discipline within the College. Formed in 2011, an academic and professional committee was created to survey the regional need and guide the College through the process of proposing a new program. In late 2013 the Ohio Board of Regents unanimously approved the new graduate program. The program was launched in 2014 in Cleveland with the goals of organizing new faculty, curriculum development, and the recruiting of students. Fall of 2014 brought together the first cohort of students and the first set of courses.

Internal discussions regarding the new landscape architecture program in the College suggested that the program be located Cleveland—the dominant city in the region—and home of the CUDC. The CUDC has been operating in Cleveland for 16 years, and through its mission as a community-based non-profit urban design practice, it has continuously engaged with community partners through its urban design work and outreach programs. The program has an urban design emphasis with many of the CUDC staff members serving as instructors. The facility supports a Master of Architecture and a Master of Urban Design, with many students seeking a dual degree in architecture and urban design.

The CUDC has merged an educational model with practice-based community design work since its founding. As part of the proposal for the new landscape architecture program, community partnerships were explored with regional stakeholders including institutions, non-profits, and allied design professionals. These stakeholders have been consulted for information on current issues and projects that might fit within the program's pedagogical interests.

By exploring the region more thoroughly and building partnerships with institutions, community groups, professionals, and engaged citizens, the program is developing a positive reputation of assistance and activism in matters related to landscape, ecological advocacy, and civic transformation. Furthermore, as the program tackles community-focused projects, external dialogue and news stories should establish the framework for combining community and academic goals together to advance pedagogy.

#### **4 CIVIC ENGAGEMENT AND COMMUNITY ACTIVISM**

When confronted with real social and environmental problems, who in the community looks at these matters with imagination and wonder?—the community leader, the design professor, and the landscape architecture student. Reticence and entrenched guardedness against

change are forces to be reckoned with; but when community-minded people sense support growing toward an unprecedented aim, they ally with those who dare to imagine a better place.

In the program, faculty explore Cleveland and its regional setting at multiple scales through design projects, tours, or related course work. The variety of scales include natural situations like subwatersheds or cultural places like neighborhoods. The design studio is an obvious platform for exploring the region—projects are typically longer in duration and the educational objectives can be broadly applied. Yet other coursework can intersect with and support the studio setting including technical courses like ecology, construction, and visual representation.

Professors and students are ambassadors, diplomats if you will, for the University and the landscape architecture profession. This may be the first time that members of a community have seen services associated with landscape architecture—and the program is responsible to ensure that the community's first experience is illuminating and competent. From a another perspective, students have the opportunity to learn about design as a service—messy, marred by circumstance, and populated by difficult and sometimes weird personalities. For students in landscape architecture programs, one lasting lesson should be that when designing something, you design it for a specific community in a certain location.

#### **4.1 THE DISTINCTIVENESS OF LANDSCAPE ARCHITECTURE**

In essence, the landscape architecture program was set in Cleveland to complement and collaborate with its existing graduate components and ally with the CUDC's practice mission. The goal for landscape architecture program is to envision the region and Cleveland through the disciplinary lens of regional climatic studies, cultural landscape theory, geographic information science, and urban ecological systems. This should result in a program that is integrated with local places and people, with a goal of forming a community-partnered educational program.

Why is landscape architecture an ideal and imperative form of community engagement for Northeast Ohio? First and foremost, it goes back to an insight of Ralph Waldo Emerson's: that despite private ownership of land, no one owns the landscape. As Emerson surmises, "There is a property in the horizon which no man has . . ."<sup>1</sup> Landscape expresses the collective aspirations and realities of the community in ways that no single land owner can take credit. And second, over time the physical landscape respects no edges, enclosures, or boundaries. Water, seeds, air, goods, waste, species, and human trespassers migrate across any imagined divisions—forming the material matrices of all social exchanges.

Roads, rails, wires, pipes, swales, waterways, flight paths, and radio and cell towers connect all discrete localities together in a spookily active bond. Visible materials, which are physical analogs for energy—weather, heat and metabolic exchanges, and all kinds of kinetic and chemical changes—comprise our landscapes and reify the activities of human, animal, and material trafficking. And third, any landscape—enmeshed and crowded into a unique geographic and climactic context—takes on a specific cultural expression and complex sense of regional identity with all its myriad stories, politics, and conversations.

Landscape architecture stands out from the other allied disciplines by its inclusiveness, its capacity to entangle various species of flora and fauna in an ecosystem designed to support multiple lives in aesthetic, technical, and practical equilibrium; and if not in equilibrium, then a profligate kind of growth that outmatches the needs of multiple species over time—and season to season. Landscape architecture is public in nature and proceeds with a much broader sense of welfare than building design in that "the public" can be broadly defined as human and non-human—the living, and the protection and renewal of the resources that sustain life and contribute to health, point to a social order that is both graceful and generous.

## 5 STUDIO-BASED SERVICE-LEARNING

The intent of service-learning design studios is to conjure a world of enfranchisement that includes, and is contrived to include others in design—in collaboration and from multiple social and cultural perspectives. This is to suggest that design problems should be directed toward, and be developed for, a community. Once put into play, the insertion of the design student into a community forces the situation where that student must confront the social, political, and cultural limits to change and progress with the given aim of improving current circumstances. Design must be more inclusive and expand both the role and definition of 'client;' resulting in better and more appropriate functioning, operating on more levels, and accommodating to all people equally.

Students of community-engaged design learn that the skills they're learning—to draw, model and represent; to visualize land, constructed form, scale, and geometry; to problem-solve through a lateral, multi-solution process; to shape complex problems into appropriate outcomes; and to think things through from general concepts to specific details—are valuable and unique instruments of service. Students learn that to be able to enact landscape architecture is a vital service that will never be replaced nor diminish as a societal need. Community shapes our most personal nature; and so we always represent our community landscapes since our mental life is shaped by encounters with community.

Landscape architects join the community to envision the places where desire meets reality. As designers, we give shape to a community's aspirations. Community engagement 'picks up the receiver' and allows students of landscape architecture to listen to the conversation between a group of people and their place—and to witness the land's profound and preeminent capacity to mirror culture.

As Vaclav Havel once said, "Hope is not a feeling of certainty that everything ends well. Hope is just a feeling that life and work have a meaning."<sup>2</sup> But we have learned by working with communities in Northeast Ohio that through design, we bring hope into the world. Hope and improvement through cultivation are what gives any landscape its intrinsic beauty. Every place makes for a continuity in time. With hope in one's heart, anything, even the most blighted of circumstances becomes nothing more than a place to begin. The improvement to any place begins as an inarticulate need that sparks into a physical representation of that hope.

### **5.1 PATTISON PARK, EAST CLEVELAND, OHIO**

In Spring Semester 2015, the Pattison Park project in East Cleveland occurred with the help of a graduate urban design student who wanted to explore the role landscape architecture students can have in creating community by taking design skills out of the studio setting to engage the public. The urban design student had three significant components in place for him to learn from and orchestrate: an able and willing faculty member, a group of enthusiastic students, and most importantly, a neighborhood partner with a clearly articulated need. The evolution of a community design engagement process took on two aspects. The first was to address community needs through a democratic, interactive, and iterative process. The second was to document the community engagement process and offer it up for academic review, personal reflection, and critical commentary. The project has developed further in a technical construction class with the study of design-build site elements. There will be further work on this project site with the support of an enthusiastic community partner.

The project was to look at the rehabilitation and renovation of Pattison Park for East Cleveland, Ohio. East Cleveland ranks among the poorest communities in Ohio with a current population of approximately 17,000, down from a crest of 40,000 in 1950. The city and school



district have been in financial emergency for decades. Poverty, underemployment, lack of opportunities, economic disenfranchisement, lack of civic maintenance, and vacancy are all pressing issues for the community. The summer Rockefeller estate once located here is now a large park managed-jointly with neighboring Cleveland Heights. The city holds two other smaller neighborhood parks, Pattison and Hawley Park, within its borders. The program was approached by the Northeast Ohio Alliance for Hope (NOAH) for help with developing a master plan for Pattison Park. The studio professor met with NOAH to determine the project possibilities and scope of community needs.

Pattison Park was built directly above the culverted Doan Brook and it is the last of a string of parks and schools that start in Cleveland and follow the historic Doan riparian corridor. This park was once adjacent to the Rozelle Elementary School, built in 1910, and demolished in 2010. The neighborhood is a mix of owner occupied houses and rentals, with few vacant houses and empty lots. The neighborhood surrounding Pattison Park is stronger than many in the city, but it is struggling to maintain its sense of community and physical integrity. NOAH is a newer community organization in East Cleveland, but it has already established itself as an important community resource and an organization that can work with the city administration in the community's best interest. Additionally, NOAH agreed to let the graduate urban design student develop and guide the community engagement process and jointly advise the studio.

The studio started with broad site research and mapping. Students were responsible for the research, the instructor for mapping, and the graduate student set out to develop the community meeting goals and tasks. NOAH was responsible for contacting community members with a target towards people that were usually active in the community. The studio instructor and graduate student conducted the site documentation the semester prior. Community engagement

was designed as a series of evening/weekend events that would start with formal mapping and documentation exercises and then lead into informal concept development employing various hands-on exercises.

The first event included a brief introduction and discussion on the primary goal, that of Pattison Park and a comprehensive mapping exercises; "tell your story," "find your routine," and "patch your holes." The studio instructor and graduate student were the meeting organizers and facilitators, while the landscape architecture students were assigned tables to interact with community members.

Students were tasked with being the moderators which included instigating discussion and documenting the results. These tasks were new to the students, and all were given training and guidelines on best practices prior to the meeting. Despite a few people dominating discussion, the basic skeleton of a complete cultural map was laid out. The next day began with a review of the previous day's mapping and collecting and summarizing together all the issues from the day before.

The main community engagement exercise was designed to share techniques from a studio-based design process with attendees. What was called the "repair clinic" began with a "broken object" exercise, and was meant to engage community members in reflecting on a social issue with given materials creatively. Community members took the broken and fragmented items to construct complete narratives based on the issues presented. The participants were asked to use these disjointed materials to construct a 2-D image followed by a 3-D model. The participants were encouraged to discuss why they made what they did, and how it was intended to address issues in the community and Pattison Park. Lunch followed these exercises and the students were counseled to keep the discussion going informally during the meal.

The exercises for afternoon were to schematically design the park. First was to conceptually arrange needed elements and discuss their relationships. This riffed off the classic bubble diagram exercise by using collage techniques made of various craft materials. Second was to repeated the earlier diagram exercise but used given scaled elements to discuss relationships. Additionally, representation of typical site elements, like circulation, vegetation, or buildings were added. The intent was to have these conceptual development exercises result in sketches that start represent the structure of the park.

Approximately one month later the second community event was scheduled. The time between these events was used by the students and faculty to evaluate the earlier meeting and begin to utilize the community's input. The students were guided through a series of studio assignments led by the instructor and graduate student. The purpose was for furthering conceptual development while also ensuring that community issues were addressed. This resulted in discussion of broad conceptual themes that addressed overarching concerns such as health, active spaces, passive gathering, water, and safety. These were represented as schematic master plans with a materials and site elements palette to help illustrate the concepts.

This second community event required students to talk to each table in a "round robin" fashion and present their concepts. Over the course of the discussion, every table of community members could see and respond to all of the design ideas, discuss the issues, and then vote on each concept. This resulted in offering general direction from the community from which the students should follow as they developed their concepts into design solutions. The goal of the project was to have a community engaged process where participation was of the highest consideration. This process was more immersed in community engagement than most academic projects, yet the results were never conceived to be fully democratic or derived blindly from an

inflexible participatory process. Each student needed to consider the many voices encountered, but provide an authoritative direction with a single design.

As it turned out, all the projects were consistent with and addressed the community's main issues. Final designs were presented at a formal community meeting. As the semester closed, NOAH and the community wanted a single concept to be developed that could be displayed at community events and leveraged for future funding. Community projects are intense and rewarding for faculty, students, and the community; but they are more than short-term commitments. It becomes difficult to manage and provide meaningful results if artificial deadlines are doggedly followed. After the last community meeting at the conclusion of the semester, NOAH wanted to keep the community momentum moving forward. A series of volunteer summertime clean-ups were scheduled with high turn out from the community. As a result of this project, the original Pattison family, the namesake for the park, rediscovered the park and started to reengage with the community.

Before the cleanups, discussion of a "beachhead" project occurred in the form of a low-cost high-impact that would rally the community. The original Rozelle Elementary School that was adjacent to the park was once an integral part of the park. Four grand cut-stone stairs led down into the park and a 50-foot diameter amphitheatre with the same wall/floor construction was located next to a wooded riparian edge. This element with an accompanying community pool and concession pavilions was the historic center of the park. The pool had been replaced by basketball courts and the pavilions are greatly dilapidated. The amphitheatre was forgotten and overtaken by successional vegetation. The landscape architecture students literally stumbled over the outlines of the old amphitheatre and it became the clearest of all beachhead projects discussed. It took two volunteer days, but the amphitheatre was cleared out and made open again with chainsaws, sweat,

and a few tears. The concession pavilions will be the focus of next year's community efforts. The landscape architecture program will support this effort with a construction class and individual actions by the students and studio professor.

## **6 AMVETS AND GARDEN DISTRICT NEIGHBORHOODS, WARREN, OHIO**

Warren, Ohio witnessed its population crest at 63,00 in 1970, with a reduction to around 41,000 today. The growth and decline of the city was guided by changes in manufacturing and regional transportation patterns. Trumbull Neighborhood Partnership (TNP) approached the CAED with the desire to address issues such as vacancy, place-making, and neighborhoods. Two CAED programs (architectural studies and landscape architecture) explored the city and developed a vertical studio experience. Architectural Studies would explore an area called "The Peninsula" and develop vignettes from urban design, landscape architecture, architecture, and industrial design perspectives. The landscape program investigated vacant lot patterns and its impact on neighborhoods.

The landscape architecture program pursued two approaches: a neighborhood vacancy master plan and ways to address vacant lots through design alternatives. Two neighborhood areas were taken under wing: The Amvets neighborhood and the Garden District neighborhood. The Amvets neighborhood was a working class and directly adjacent to manufacturing. The houses are tightly spaced with minimal community space. The neighborhood was once very vital during the city's industrial apex. Over time, working class jobs moved out of the city and the neighborhood became unstable. Vacancy and property abandonment has been issues for many decades.

The students looked at issues such as vegetation, hydrology, and topography as well as cultural patterns such as schools, ownership, and community events. The analysis and research efforts went positively for the instructor and students, but when community needs and resources

were considered, the framework to support a master plan was insufficient. The master planning concepts pursued by the students spanned in scope ecological systems to neighborhood connections. All were valid concepts, but the master plan approach was revised to a decentralized and incremental strategies.

A decentralized approach was used in the Garden District Neighborhood. This neighborhood is close to the downtown and the housing stock and lots are generally larger. The problem of vacancy is less prevalent if compared to the Amvets neighborhood, but the effect is greater due to differences in land density. This required the students to take a different approach to the design problem.

The students explored various options from the streetscape to individual parcels. The most successful design strategy developed a decision matrix that organized lots by attributes such as corner or midparcel, lot orientation, vegetation succession, adjacent uses. A series of questions directed the user to program options, which led to design proposals. This helped TNP organize various strategies because the character of vacancy differs in each situation.

TNP organized focus groups with community members; the interaction with students was structured as charrettes where concepts were sketched, but the most important interaction during these events were dialogues with and between stakeholders. The designers quickly started to understand how simple some of the site elements could be and the community started to understand that while simple concepts could be pursued it would be the management of the spaces and community commitment that would guide success.

The student work was presented to the community at a formal meeting along with work by Architectural Studies students. The solutions were well received with the landscape proposals closely linked to vacancy issues gaining the most interest from the community. TNP gathered the

vacancy ideas and organized them for future discussions with community members. This project had less community engagement than the Pattison Park project. This was because teaching objectives did not align with the support available from the community stakeholders. One of the unfulfilled objectives for Warren was the interaction with community throughout the design process. Despite this downfall, one of the landscape students was brought in for a summer internship and was able to work through a design-build project on a vacant lot.

## **7 DISCUSSION**

As designers, we project. And when we project, we focus effort toward the future. Landscape architects aim to address a problem, but with the hope that the relations they establish between people, other species, and non-human actors will take root and persist well into the future. Vaclav Havel has said that hope is a state of mind, not of the world. Hope, and at other times the despair of loss, are communal feelings. We must hope, but not alone; we hope together. We must hold on to hope, despite the ancient wisdom of Heraclitus that, "History is a child building a sand-castle by the sea, and that child is the whole majesty of man's power in the world."<sup>3</sup>

It must be understood, up front and by all, that the equivocal goals of establishing a context for learning, while simultaneously providing a useful outcome for the client, must not compete against one another— otherwise the latter might cancel the former goal out. There can be reciprocity between the goals of the professor (to develop an environment that exercises skills and creativity in a service-learning context), the expectations of the client (to give substance and vision to a nagging problem), and the competing desires of students (to serve their community, to learn something new, to experience teamwork, and earn a grade).

A person engages in service by thoughts of contributing to something larger than the self. Hope commits us to seeking out the best of anything—and forces everyone engaged in the solution to do something to make it happen. The sharing of hope gives the whole process of community design its effervescent meaning. It is within the "romantic triangle" of these reciprocating expectations where give-and-take is of the essence. But when a client disarms everyone and offers prayers, hugs, and a down-home meal of fantastic fried chicken and the best damn mac 'n' cheese you ever tasted—then the gratitude gathered by good hospitality always helps and never hurts—no matter how cynical the student or the professor.

But once a university program begins to help, it must continue to be active in a community where long-term help is needed. The seeds we plant through community design tend to take tentative root, sprout shoots, and lead to trees that grow in unexpected ways and require additional nurturing. In the end, the community becomes emboldened, proactive, and considers physical change as inevitable and shapeable. The most important lesson learned by all is that we are culpable for our future, and that future can be guided through design.

Community-engaged design, as well as other forms of civic engagement and service-learning, must represent a long-term commitment between the program and its community partners. Rarely can a community be engaged in clinical manner, where only a single semester worth of work will finalize the partnership. Great care and careful coordination must be considered when conversing with community partners and developing the project and timeframe. Deadlines are important for progressing on a project, but keeping an open dialogue as to the educational objectives and community goals is critical to the long-term success. Professional partners who may later assist the stakeholder, either for-profit or pro-bono, can continue the project if the unforgiving timeframe of the academic calendar won't suffice to fulfill aspirations of the community partner.



Through this approach, our landscape architecture students learn that they never operate in a vacuum; that they are always forming a community wherever and whenever they work. Hopefully, this attitude will embolden them into becoming better practitioners since they are on the road to learning that landscape architects must be community advocates seeking to improve environments, establish fruitful relations, gather together group consensus, and produce positive change.

## **8 CONCLUSION**

"Hope, in this deep and powerful sense, is not the same as joy that things are going well, or a willingness to invest in enterprises that are obviously heading for success, but rather an ability to work for something because it is good."— Havel, V. (1990). *Disturbing the Peace* (p. 181). New York, NY: Alfred A. Knopf.

Addressing the design needs of community partners becomes a service that the university provides, an outlet for faculty leadership and expertise, and the chance to offer students two experiences that traditional studio's lack. The first experience is interacting with the public on a project of real and earnest interest to the community. And second, exposure to the notion that an inherent good gets imparted to the public when assisting the community, regardless if one is getting paid or not. The emerging talents of landscape architecture students should not be confined to only the campus or well-controlled hypothetical problems.

Bringing students together with a community partner is to witness the emergence of each student's character—the instructor can see the individualizing mark of the student emerge. The qualities of a person become apparent when set into action upon the background of the community. The truest design decisions are made when we tie our ethics to a real and earnestly regarded problem. A citizen is an enfranchised and contributing member of their place and exercises their right to input in their community. The motive behind university-community engagement should be

to acculturate the student designer into being an active member of the community. Ultimately, an activist is a participant in the political process, a member of the community who wishes to be heard and enact improvements to their place. What better lesson could be taught than to put students in a place where they might recognize that design is always a form of community activism?

## 9 ENDNOTES

<sup>1</sup> Emerson, R. W. (1965). Nature; Chapter 1. In *Selected Writings of Ralph Waldo Emerson* (p. 188). New York, NY: The New American Library.

<sup>2</sup> Morrow, L. (1990, September 17). The Anatomy of Hate. *Time*. 136 (12).

<sup>3</sup> Davenport, G. (1979). Herakleitos and Diogenes (p. 15). San Francisco, CA: Grey Fox Press.

## Bio's

Charles Frederick  
Kent State University

Charles Frederick, RLA, ASLA, LEED AP received his Bachelor's degree from Kent State University and his Master's degree from the University of Virginia. He has taught architecture, urban design, and landscape architecture at Kent State University's College of Architecture and Environmental Design for 16 years. In 2014 a graduate landscape architecture program was founded where he has a leadership role. He is a practicing landscape architect with a focus on community centered design/build.

William T. Willoughby  
Kent State University

William T. Willoughby, AIA, NCARB is an architect, educator, and essayist who began his career at Kent State University. He taught at the University of North Carolina at Charlotte and became an architectural educator and administrator at Louisiana Tech University where founded the Community Design Activism Center in 2000. In 2013, he returned to Kent State University's College of Architecture and Environmental Design to serve as Associate Dean and Associate Professor. He teaches at the Cleveland Urban Design Collaborative and has written and published for 20 years on architecture and design from a cultural studies perspective.

## **WATER-BASED SPATIAL ANCHOR AS THE SIXTH ELEMENT OF IMAGEABILITY**

### **RISING, HOPE**

Visiting Professor, Landscape Architecture, Pennsylvania State University

### **ABSTRACT**

*Waterscapes have been found to emerge first in sketch maps regardless of their cognitive forms as landmarks, paths, nodes, edges, or districts (Lynch, 1960; Milgram, 1976; and De Jonge, 1962). These findings suggest that waterscapes may be higher-order spatial anchors (Golledge, 1992; Golledge & Stimson, 1997, Osmond, 1963). This study tested the hypothesis that water-based spatial anchors may be the sixth element of imageability that emerges before other non-water landmarks, paths, nodes, edges and districts during spatial memory recall despite its imageability element. The author sampled 55 sketch maps from 8 water cities and colored water elements blue to generate 55 colored sketch maps. To measure uncolored map identifiability (UMI) and colored map identifiability (CMI) as dependent variables for regression models, raters 1 and 2 were asked to identify the city associated with each uncolored sketch map and raters 3 and 4 with each colored sketch map. To assess the contribution of water to CMI, raters 3 and 4 were asked to indicate the extent to which the map's blue features helped the raters identify the city on a 3-point Likert scale. The contribution of water was used to weight CMI to generate the dependent variable of water-based colored map identifiability (WMI). The author used cognitive mapping, photovoice, and non-visual protocols to measure waterscape mappability, identifiability, and attachment as explanatory variables. In addition to socioeconomic variables, the regression models also included education and aquaphilia sensitivity baseline to control for the effects of map exposure and people's instinctual attachment to water on UMI, CMI and WMI. The results of the three regression analyses suggest that water is distinctly different from the conventional elements of imageability, which are landmarks, paths, nodes, edges, and districts. The salience of water-based spatial anchors can be expected to contribute to the imageability of water cities.*

### **1.1 Keywords**

Imageability, identifiability, sketch map, water cities, waterscapes, spatial anchors

## **2 INTRODUCTION**

### **2.1 Comfort from aquaphilia as instinctual human affection toward water**

In *The Image of the City*, Lynch (1960) pointed out that his participants' favorite views were

usually panoramas with water and spatial openness. He also noted an emotional delight arising

from his participants who mentioned broad views with water. However, he did not point out water as a separate element of imageability. Coss (1990) attributed people's preferences for water scenes and the optical properties of water, especially glossiness, to the evolutionary advantage of being able to identify clean drinking water. These observations suggest a possible association between water-based imageability and aquaphilia, which the author defines as an innate emotional bond with safe and clean water or water-centric environments.

## **2.2 Water-based spatial anchors as the sixth element of imageability**

Although Lynch's (1960) theory only postulated five cognitive forms, landmarks, paths, nodes, edges, and districts, as possible contributing elements of imageability, many discovered that waterscapes seemed to emerge first in sketch maps regardless of their cognitive forms (Lynch, 1960; Milgram, 1976; and De Jonge, 1962). Lynch (1960) described the Charles River as an edge in Bostonians' cognitive maps. Milgram (1976) noted the appearance of the river Seine among the first elements on many sketch maps of Paris. It is unclear if the salience of the river Seine in the cognitive maps for Paris may be attributed to its cognitive form as an edge or to its simple presence as water. In an imageability study conducted by De Jonge (1962) with visitors and residents in three Dutch water cities, waterscapes seemed to emerge as the first features in sketch maps regardless of the waterscapes' cognitive forms as elements of imageability. He also observed greater detail in sketch maps drawn at closer proximity to water bodies. These results suggest the high likelihood that water-based elements may be higher-order spatial anchors—organizers of spatial information in cognitive maps according to the anchor-point theory (Golledge, 1992; Osmond, 1963).

## **2.4 Hypothesis**

This study intended to test the hypothesis that water-based spatial anchors may be the sixth element

of imageability that emerges before other non-water landmarks, paths, nodes, edges, and districts, during recall of cognitive map and image, regardless of its imageability element. This hypothesis suggests that the salience of waterscapes in spatial memory can be expected to contribute to the imageability of water cities and facilitate the formation of more coherent cognitive maps.

### **3 METHODS**

#### **3.1 Sketch-map identifiability as a measure of environmental imageability**

Survey knowledge has often been assessed using sketch maps for studying spatial abilities (Beck & Wood, 1976; Evans, 1980). Blades (1990) validated test-retest reliability of sketch maps for evaluating spatial knowledge. This study asked participants to draw sketch maps only once. Sketch map identifiability has been found to correlate with environmental configuration (Kim & Penn, 2004) and to reflect environmental affordance for self-orientation (Southworth, Cranz, Lindsay, & Morhayim, 2012). De Jonge (1962) found that visitors and residents were likely to show, in their sketch maps, a spatial arrangement composed of separate elements with clear identity for locations where self-orientation was easy. This suggests that the identifiability of sketch maps is likely an external expression of the identifiability of the actual physical environment they represent. As an identifiable environment was postulated to contribute to the imageability of water-centric cities (Lynch, 1960), this study thus assumed sketch-map identifiability a likely measure of environmental imageability.

#### **3.2 Relating the definition of imageability to its five elements and three components**

Lynch (1960) alluded to imageability as a pattern of high continuity with distinct yet interconnected parts. This definition seems to suggest that imageability could be attributed to the combination of identity and structure provided by landmarks and uninterrupted paths and edges. Lynch (1960) did not, however, explicitly clarify or empirically test how this definition of imageability relates to his five elements of imageability (landmark, path, node, edge, and district)

with reference to his three cognitive components of imageability (structure, identity, and meaning). Regression analyses were conducted to relate the construct of imageability to its five elements and three components as explanatory variables.

### **3.3 Regression model dependent variables**

**Map identifiability variables.** To assess the contributions of the five water elements and three components of waterscape imageability to the identifiability of sketch maps, the author colored their water elements blue. Then, the investigator assessed the identifiability of the cities represented by uncolored and colored sketch maps to generate scores for uncolored map identifiability (UMI) and colored map identifiability (CMI) as dependent variables for two regression models. The contribution of water was also assessed to create a multiplier for CMI in order to derive the value for water-based map identifiability (WMI), the dependent variable for another regression model.

### **3.4 Regression model independent variables**

**Waterscape mappability identifiability, and attachment.** The author used the combinations of 5 waterscape types (water landmarks, canals, lakes, rivers, and harbors) and 3 components of imageability (structure, identity, and meaning) to generate 15 explanatory variables for each of the regression models using sketch map identifiability variables, UMI, CMI, and WMI. A water landmark is a landmark along and/or across a body of water. To measure waterscape structure, waterscape identity, and waterscape meaning, the investigator employed the top-down, eye-level, and emotional perspectives for probing the participants' spatial memory recall sequence through interview instructions and questions.

**Aquaphilia sensitivity baseline.** As comfort has been found to affect people's emotional connection with networks of open spaces and waterways (Mansor & Said, 2008), the extent to

which water helps participants relax was used to measure their aquaphilia sensitivity baseline as a control variable.

### **Education as a control variable for informational influences on sketch-map identifiability.**

Previous investigations into the influence of map exposure on sketch maps and spatial comprehension have been inconclusive. Some found no correlation between map exposure frequency and sketch-map accuracy (Devlin, 1976), while others noted spatial performance improvement due to map exposure (Devlin & Bernstein, 1995). Kreimer (1973) discovered that the foregrounding of specific elements in environmental cognition were often associated with the extensive use of secondary information sources, such as television, newspapers, and radio, as opposed to direct environmental exposure. The author proposed education as a rough proxy for controlling the effect of exposure to maps and secondary information sources on sketch map identifiability in order to study the influence of direct environmental experience.

## **4 DATA COLLECTION**

### **4.1 Selection of water cities**

Google search indicated that 12 cities have been referred to as “Venice of the North” because of their water-based appeal to visitors and residents. Wikipedia provides a list of 10 such cities: Amsterdam, Bruges, Copenhagen, Giethoorn, Hamburg, Henningsvær, Manchester, 's-Hertogenbosch, Saint Petersburg, and Stockholm. Berlin (MacLean, 2011) and Ghent (Raplee, 2010) have also been compared to Venice. Among this shortlist of alluring water cities, the author chose 6 as study sites based on precipitation pattern similarity and geographical proximity for cost of sampling as selection criteria. These first six cities selected were Amsterdam and Giethoorn in the Netherlands, Ghent and Bruges in Belgium, and Berlin and Hamburg in Germany. Only Amsterdam and Hamburg are coastal cities with harbors in proximity; the other

four are inland water cities. Rotterdam and Almere, the 2 fastest-growing polder cities in the Netherlands, were also appealing water cities with easily accessible harbors. (Kwadijk et al., 2010; Tao & Zhengnan, 2013). These 2 coastal polder cities were thus added to the selection of study sites, for a total of 8 cities

#### **4.2 Recruitment of field participants**

A simple and obvious sampling frame for residents and tourists in these 8 cities does not exist.

The author therefore randomly sequenced sampling sites to recruit participants in order to create an approximation of a random sample derived from a theoretical sampling frame. This theoretical sampling frame assumed it was possible to capture all residents and visitors in each water city.

The investigator used a randomized order to sequence the 8 cities. Each city's 9 sampling sites always included major entry points (such as airports, inter-city train stations, and bus stations), city halls, and tourist bureaus, and various hotels, cafés, ethnic stores, and universities.

The author chose these sites to sample a representative mix of residents and visitors, high- and low-income populations, environmental design experts and non-experts, and immigrants and visitors from various countries of origin. Each sampling site was sampled for 5 hours, for a total of 45 hours for each water city.

#### **4.3 Field interviews**

The author recruited 60 semi-structured interview participants from sampling sites in all eight cities. As shown in Table 1, during each interview, the investigator conducted cognitive mapping (item 1), photovoice (item 3), and non-visual protocols (item 4) to prompt the participant to recall the city as the first five features to emerge from a 2-dimensional top-down cognitive map, the first 5 photograph-like eye-level cognitive images to surface from spatial memory, and the 5 elements that would be most missed if the participant had to leave the city the next day.



**Table 1. Interview items and coding for environmental factor variables**

Variables	Interview items for field participants
Waterscape mappability <sup>ab</sup>	1. Cognitive mapping protocol: Imagine you are drawing a map of the city. Please name or describe the 5 features or locations that come to mind first. Please do not consult a city map.
Sketch Map Identifiability <sup>c</sup>	2. Sketch map protocol: Please draw a map of your city on the next page. Include as many features as you can recall. Number the features directly on the map to indicate the sequence in which they emerged from your memory.
Waterscape identifiability <sup>ab</sup>	3. Photovoice protocol: If you were to take 5 pictures of the city to describe it to someone who has never been there, what would you take pictures of?
Waterscape attachment <sup>ab</sup>	4. Non-visual protocol: What are the 5 things you would miss about the physical environment if you had to leave the city tomorrow?

a. Code each answer 1 or 0 based on whether it contains a target waterscape, assign a weight from 5 to 1 to account for the sequence of recall, and use a weighted average to create variable measures.

b. A targeted waterscape can be a canal, river, lake, harbor, or a water landmark (a landmark along and/or across a body of water).

c. The sketch map was used to generate three sketch map identifiability measures (UMI, CMI and WMI) as described in Section 2.7.

The author used these three recall protocols to assess the mappability, identifiability, and attachment of the 5 waterscape types in relation to their salience in cognitive maps. The targeted waterscape types included canal, river, lake, harbor, and water landmark. Immediately after the cognitive mapping protocol, the investigator conducted the sketch-map protocol (item 2) to instruct each participant to draw a map of the city while keeping track of the sequence in which each feature appeared in his or her memory. Some 60 interviews resulted in 55 sketch maps because 5 participants could not draw their cognitive maps from recall. Table 2 illustrates other interview questions for measuring individual factors, which includes two control variables (aquaphilia sensitivity baseline and education) and socioeconomic variables (gender, income, and visitor/resident).

**Table 2. Interview items and coding for individual factor variables**

Independent variables	Interview items for field participants Coding
Age	5. In what year were you born? (convert answer to age)
Aquaphilia sensitivity baseline <sup>a</sup>	6. If you could live anywhere, would you choose to live? <input type="checkbox"/> Right on the water (5) <input type="checkbox"/> With easy access to water (4) <input type="checkbox"/> With visual access to water only (3) <input type="checkbox"/> Far away from water (2) <input type="checkbox"/> As far away from water as possible (1)
Education <sup>a</sup>	7. What is the highest level of education you have completed? <input type="checkbox"/> Graduate degree (5) <input type="checkbox"/> Higher education (Bachelor's degree) (4) <input type="checkbox"/> Some college (3) <input type="checkbox"/> Secondary school (2) <input type="checkbox"/> Elementary school (1)
Gender	8. Which sex or gender do you identify with? <input type="checkbox"/> Female (2) <input type="checkbox"/> Male (1) <input type="checkbox"/> Other (0)
Income <sup>a</sup>	9. Approximately what was your total household income for 2012? Please include all income sources for every member in your household. <input type="checkbox"/> Less than €15,000 (4) <input type="checkbox"/> €15,000–€30,000 (3) <input type="checkbox"/> €30,000–€45,000 (2) <input type="checkbox"/> More than €45,000 (1)
Visitor/ Resident	10. How many years/days have you lived in this city (altogether)? Code length of exposure with 1 or 2 for less than or more than 90 days, respectively, to differentiate visitors from residents.

a. Assume response categories as equally spaced points along a Likert scale to generate scores as shown above in parentheses.

## 5 DATA ANALYSIS

### 5.1 Coding for field data

For items 1, 3, and 4 in Table 1, the investigator assigned a base score of 1 or 0 to each response depending on whether it contained one of the five targeted waterscapes. The basis for classifying these waterscapes was on the literal use of the waterscape terms or the names of actual water bodies in participants' responses. When a waterscape type was unclear in a response, the investigator asked the participant to clarify before ending the interview. The author applied a weight of 5 to the base score for the first answer, 4 for the second, and so forth, to account for the significance of each waterscape type's recall sequence. As shown in the following formula, the investigator took a weighted average from the sum of all five weighted base scores:

$$\text{Weighted average} = (5 * \text{first answer base score} + 4 * \text{second answer base score} + 3 * \text{third answer base score} + 2 * \text{fourth answer base score} + 1 * \text{fifth answer base score}) / 5$$

This formula was used to derive, from the results of the cognitive mapping, photovoice, and non-visual recall protocols in Table 1, the mappability, identifiability, and attachment measures, respectively, for canal, harbor, lake, river, and water landmark.

As shown in Table 2, the investigator used a five-point Likert scale to ordinate the score for aquaphilia baseline (item 6) and education (item 7), and a four-point scale for income (item 9). For gender (item 8), female and male were coded 2 and 1, respectively. Each participant's birth year was subtracted from 2015 to calculate age (item 5). Length of exposure was coded as 1 or 2 if it was less or more than 90 days, respectively, for the group variable of visitor versus resident because the Schengen visitor visa allows its holder to stay up to 90 days.

## **5.2 Sketch map evaluation protocol**

Several studies utilized two independent raters to analyze sketch maps to establish inter-rater reliability for measures that could be influenced by subjective judgments (Ferguson & Hegarty, 1994; Maguire, Burke, Phillips, & Staunton, 1996; Quaiser-Pohl, Lehmann, & Eid, 2004). Independent raters without previous exposure to either the study or the 8 cities were recruited for evaluating the identifiability of 55 sketch maps. These 55 sketch maps were presented in a randomized sequence in Qualtrics for comparison with 8 city maps.

During the first sketch map survey, raters 1 and 2 were guided by written instructions to glance at the 8 city maps for no longer than 10 seconds to determine whether they could recognize the city represented by each sketch map by answering item 1 in Table 3. The author assigned a code of 1 or 0 to this item when each sketch map was identified successfully or not, respectively, to generate the measure of uncolored map identifiability (UMI).

The author colored the water elements in the same 55 sketch maps in blue for evaluation by raters 3 and 4, who also had no previous exposure to the study or the 8 cities. They were asked to scan 8 city maps for no longer than 10 seconds to identify the city associated with each colored sketch map using item 1 in Table 3. The author then assigned a code of 1 for correct and 0 for incorrect and unsure identification of each sketch map to generate the measure for the variable of colored map identifiability (CMI).

Raters 3 and 4 were also asked to assess the extent to which blue features contribute to the identifiability of each map by answering item 2 in Table 3. The item assumed its 3 response categories as equally spaced points along a 3-point Likert scale to generate scores for contribution of water (CW). The measure for water-based map identifiability (WMI) was generated by multiplying colored map identifiability (CMI) with the contribution of water (CW).

**Table 3. Survey questions and coding schemes for map identifiability measures**

Variable	Descriptive Name	Colored sketch map survey items Coding schemes
UMI <sup>ac</sup> / CMI <sup>bc</sup>	Uncolored/colored map identifiability	1. This is a map of what city? <input type="checkbox"/> Almere <input type="checkbox"/> Amsterdam <input type="checkbox"/> Berlin <input type="checkbox"/> Bruges <input type="checkbox"/> Ghent <input type="checkbox"/> Giethoorn <input type="checkbox"/> Hamburg <input type="checkbox"/> Rotterdam <input type="checkbox"/> Not Sure
CW <sup>d</sup>	Contribution of water	2. To what extent do the map's blue features help you identify the city? <input type="checkbox"/> Very much (3) <input type="checkbox"/> Somewhat (2) <input type="checkbox"/> Not (1)
WMI	Water-based colored map identifiability	3. The contribution of water to correct colored map identification. Colored map identifiability (CAI) * contribution of water (CW)

- a. For raters 1 and 2 during the first sketch map survey using uncolored sketch maps.
- b. For raters 3 and 4 during the second sketch map survey using colored sketch maps.
- c. Code 1 for correct or 0 for incorrect/unsure responses.
- d. Assume response categories as equally spaced points along a Likert scale to generate scores as shown above in parentheses.

### 5.3 Inter-rater reliability tests

The investigator calculated the intra-class correlation coefficients (ICCs) of all map identifiability measures in Table 3. in SPSS 22 using a 2-way mixed model and an absolute agreement definition, as suggested by McGraw and Wong (1996), to assess their reliabilities between raters.

Along with the Cronbach's alpha as a commonly used inter-rater reliability indicator, SPSS provided the ICC average measure to assess the proportion of a variance attributable to judges for the average ratings of two independent raters.

ICC values between 0.60 and 0.74 are commonly cited as cutoffs for good inter-rater reliability (Cicchetti, 1994; Hallgren, 2012). Several studies used 0.6 as an acceptable ICC threshold (Baumgartner & Chung, 2001; Ostroff & Schmitt, 1993) and as an acceptable threshold for determining internal consistency reliability with Cronbach's alpha (Hume, Ball, & Salmon, 2006). As the lower bound of a reliability coefficient, Cronbach's alpha does not require measures of precision, such as confidence intervals (Cronbach, 1951). This study used 0.6 as the cut-off value for both ICC and Cronbach's alpha to qualify reliability between raters.

Each reliability map identifiability measure was then employed as a dependent variable with all 15 independent waterscape variables in Table 1 in a subtractive stepwise regression analysis, which eliminated variables whose omissions did not result in a significant F-value change. The investigator subsequently conducted an additive stepwise regression analysis with the 6 factors in Table 2. These 6 factors were added to the stepwise regression as independent variables one at a time with the significant waterscape variables identified by the subtractive stepwise regression analysis. If a change in F-value was significant due to the addition of an independent variable, the variable was retained in the final regression model for each map identifiability measure as the dependent variable. A power analysis conducted in G\*Power 3.1.9.2 suggested that the sample size ( $N=55$ ) provided sufficient power ( $d=0.804>.8$ ,  $\alpha=0.05$ ) for regression models with one dependent variable and five independent variables. The regression model  $R^2$  was evaluated based on Cohen's (1988) standards of 0.02 for small, 0.13 for medium, and 0.26 for large effect sizes.

## 6 RESULTS

### 6.1 Inter-rater reliability of sketch map identifiability measures

Both uncolored map identifiability (UMI) and colored map identifiability (CMI), were reliable

( $\alpha_{UMI} = .7 > .6$ ,  $ICC_{UMI} = .7 > .6$ ,  $p_{UMI} < .001$ ;  $\alpha_{CMI} = .7 > .6$ ,  $ICC_{CMI} = .7 > .6$ ,  $p_{CMI} < .001$ ). Acceptable

inter-rater reliability was also observed for water-based map identifiability (WMI) ( $\alpha_{WMI} = .7 > .6$ ,  $ICC_{WMI} = .7 > .6$ ,  $p_{WMI} < .001$ ).

### 6.2 Comparisons of regression analyses

Tables 4 and 5 illustrate the final regression results for three map identifiability measures with independent variables that significantly improved their subtractive and additive stepwise regression results. Education was a significant independent variable for colored map identifiability (CMI) and marginally significant for water-based map identifiability (WMI).

**Table 4 Model summary and ANOVA for predicting sketch map identifiability**

Dependent variable (x)	R	Rx 2	Rx 2_a	SE	df_m	df_r	F
Uncolored map identifiability (UMI)	.57b	.32	.28	.37	3	51	7.96***
Colored map identifiability (CMI)	.62b	.38	.35	.35	3	51	10.53***
Water-based map identifiability (WMI)	.70b	.48	.45	.81	3	51	15.78***

a. \*\*\* $p < .001$ .

b. Predictors: (Constant) Aquaphilia baseline, canal mappability, education

For comparison, education was included for the uncolored map identifiability (UMI) model although it did not significantly improve its additive stepwise regression ( $\Delta F_{UMI}(1,53) = .91$ ,  $p_{UMI} = .35 > .05$ ). Some 32% of the variance in the uncolored map identifiability (UMI) ( $R_{UMI}^2 = .32$ ,  $F_{UMI}(3, 51) = 7.96$ ,  $p_{UMI} < .001$ ) could be attributed to the significant positive effect of canal mappability ( $\beta_{UMI} = .47$ ,  $t_{UMI}(51) = 4.02$ ,  $p_{UMI} < .001$ ) and the significant negative effect of aquaphilia sensitivity baseline ( $\beta_{UMI} = -.30$ ,  $t_{UMI}(51) = -2.61$ ,  $p_{UMI} < .05$ ) with education, or map and

informational exposure, as an insignificant control variable ( $\beta_{UMI}=.10$ ,  $t_{UMI}(51)=.83$ ,  $p_{UMI}=.41>.05$ ).

In contrast, for colored sketch maps, 38% of the variance in their map identifiability (UMI) ( $R_{UMI}^2=.38$ ,  $F_{UMI}(3, 51)=10.53$ ,  $p_{UMI}<.001$ ) and 48% in their water-based map identifiability (WMI) ( $R_{WMI}^2=.48$ ,  $F_{WMI}(3, 51)=15.78$ ,  $p_{WMI}<.001$ ) could be explained by the significant positive influences of canal mappability ( $\beta_{UMI}=.47$ ,  $t_{UMI}(51)=4.23$ ,  $p_{UMI}<.001$ ;  $\beta_{WMI}=.56$ ,  $t_{WMI}(51)=5.51$ ,  $p_{WMI}<.001$ ), the significant and marginally significant positive influences of education as a proxy indicator for map and informational exposure ( $\beta_{UMI}=.24$ ,  $t_{UMI}(51)=2.11$ ,  $p_{UMI}<.05$ ;  $\beta_{WMI}=.19$ ,  $t_{WMI}(51)=1.82$ ,  $p_{WMI}=.07<.10$ ), and the significant negative influences of aquaphilia sensitivity baseline ( $\beta_{UMI}=-.32$ ,  $t_{UMI}(51)=-2.87$ ,  $p_{UMI}<.01$ ;  $\beta_{WMI}=-.36$ ,  $t_{WMI}(51)=-3.57$ ,  $p_{WMI}<.001$ ).

**Table 5. Regression coefficients for predicting map identifiability measures**

	Unstandardized Coefficients		Standardized Coefficients		Collinearity Statistics		
	B	Std. Error	Beta	t	Sig.	Toleranc e	VIF
Dependent Variable: Uncolored Map Identifiability ( <i>UMI</i> )							
(Constant)	.50	.25		1.99	.052		
Canal Mappability	.08	.02	.47	4.02	.000	.98	1.02
Aquaphilia Sensitivity Baseline	-.18	.07	-.30	-2.61	.012	.99	1.01
Education	.04	.05	.10	.83	.413	.98	1.03
Dependent Variable: Colored Map Identifiability ( <i>UMI</i> )							
(Constant)	.28	.24		1.18	.244		
Canal Mappability	.08	.02	.47	4.23	.000	.98	1.02
Aquaphilia Sensitivity Baseline	-.19	.07	-.32	-2.87	.006	.99	1.01
Education	.11	.05	.24	2.11	.039	.98	1.03
Dependent Variable: Water-Based Map Identifiability ( <i>WMI</i> )							
(Constant)	.95	.54		1.74	.088		
Canal Mappability	.22	.04	.56	5.51	.000	.98	1.02
Aquaphilia Sensitivity Baseline	-.55	.15	-.36	-3.57	.001	.99	1.01
Education	.21	.12	.19	1.82	.074	.98	1.03

When the model accounted for the extent to which water contributes to colored map identifiability, the author observed several model improvements: 1) The positive influence of canal mappability and the negative influence of aquaphilia baseline increased, 2) The positive influence and significance of education or map and informational exposure as potential confounds decreased, and 3) As the tolerances of all variables were above 0.8, these 3 models were robust to multicollinearity.

Since education, or map and informational exposure, was insignificant for the identifiability of uncolored maps, the salience of blue, which the investigator used to highlight water elements on a city map, may have contributed to its effect for colored maps. While education, or map and informational exposure, was significant for the identifiability of colored maps, it was marginally significant for water-based map identifiability. That is, the identifiability of colored maps was likely weighted by the contribution of water. It is possible that the contribution of water may have introduced other significant influences beyond the three significant predictors, namely, canal mappability, aquaphilia sensitivity baseline, and education. Finally, a negative linear trend was observed between the standardized predicted value and standardized residual in the scatter plots for all three models. The trend suggests that all three models may be enhanced with additional significant variables to account for the remaining systematic pattern in the scatter plots.

## **7 Discussions**

### **7.1 Water as a Separate Element of Imageability**

For colored sketch maps, education was significant for map identifiability and marginally significant for water-based map identifiability. Participants with more education were more likely to produce identifiable colored sketch maps. This significant relationship became marginal,



however, when accounting for water's contribution to the identifiability of these colored sketch maps. The findings suggest that although those with more education are more likely to have a higher level of map and informational exposure, participants' greater recall salience for blue water elements on cartographic maps and other informational sources may have been attributed to aquaphilia sensitivity baseline rather than education. Furthermore, the significant effect of education on sketch map identifiability was hidden for the identifiability of uncolored sketch maps. The result may indicate water as distinctly different from, and more cognitively powerful than, the conventional elements of imageability, which are paths, landmarks, nodes, edges, and districts. The findings of this study could suggest that the integration of waterscapes into urban fabrics could help make cities more legible. The aesthetic coherence of water urbanism may facilitate newcomers' and visitors' environmental familiarity with cities, and therefore make these cities more appealing as tourist destinations and places of residence.

### **7.3 Future directions**

A more direct understanding of the interactions between cognitive forms and aquaphilia will be important for confirming whether water-based imageability is entirely independent of cognitive forms. Future research should investigate aquaphilia on smaller sites with the use of specific spatial-temporal recording of environmental experience, eye-tracking data, and psychophysiological measurement. Researchers should also measure participants' psychophysiological baselines and obtain pre- and post-experience behavioral measures using the same cognitive mapping, photovoice, and emotional recall measures. By simultaneously recording participants' psychophysiological measurements and eye-tracking data, researchers can better differentiate changes in psychophysiological measurements due to visual fixations on water-based versus non-water-based environmental features.

## 8 REFERENCES

- Baumgartner, T. A., & Chung, H. (2001). Confidence limits for intraclass reliability coefficients. *Measurement in Physical Education and Exercise Science*, 5(3), 179-188.
- Beck, R. J., & Wood, D. (1976). Cognitive transformation of information from urban geographic fields to mental maps. *Environment and behavior*, 8(2), 199-238.
- Blades, M. (1990). The reliability of data collected from sketch maps. *Journal of Environmental Psychology*, 10(4), 327-339.
- Cicchetti, D. V. (1994). Guidelines, criteria, and rules of thumb for evaluating normed and standardized assessment instruments in psychology. *Psychological assessment*, 6(4), 284.
- Coss, R. G. (1990). All that glistens: Water connotations in surface finishes. *Ecological Psychology*, 2(4), 367-380.
- Cronbach, L. J. (1951). Coefficient alpha and the internal structure of tests. *psychometrika*, 16(3), 297-334.
- De Jonge, D. (1962). Images of Urban Areas Their Structure and Psychological Foundations. *Journal of the American Institute of Planners*, 28(4), 266-276.
- Devlin, A. S. (1976). The “small town” cognitive map: Adjusting to a new environment. *Environmental Knowing: Theories, Research and Methods*. Dowden, Hutchinson and Ross.
- Devlin, A. S., & Bernstein, J. (1995). Interactive wayfinding: Use of cues by men and women. *Journal of Environmental Psychology*, 15(1), 23-38.
- Evans, G. W. (1980). Environmental cognition. *Psychological bulletin*, 88(2), 259.
- Ferguson, E. L., & Hegarty, M. (1994). Properties of cognitive maps constructed from texts. *Memory & cognition*, 22(4), 455-473.
- Golledge, R. G. (1992). Place recognition and wayfinding: Making sense of space. *Geoforum*, 23(2), 199-214.
- Golledge, R. G., & Stimson, R. (1997). Spatial behaviour: A geographic perspective. *Guilford, London*.
- Hallgren, K. A. (2012). Computing inter-rater reliability for observational data: An overview and tutorial. *Tutorials in quantitative methods for psychology*, 8(1), 23.
- Hume, C., Ball, K., & Salmon, J. (2006). Development and reliability of a self-report questionnaire to examine children's perceptions of the physical activity environment at home and

in the neighbourhood. *International Journal of Behavioral Nutrition and Physical Activity*, 3(1), 16.

Kim, Y. O., & Penn, A. (2004). Linking the spatial syntax of cognitive maps to the spatial syntax of the environment. *Environment and behavior*, 36(4), 483-504.

Kreimer, A. (1973). Building the imagery of san francisco. An analysis of controversy over high-rise development, 1970-71. *Environmental Design Research*, 2, 221-231.

Kwadijk, J. C., Haasnoot, M., Mulder, J. P., Hoogvliet, M., Jeuken, A., van der Krogt, R. A., . . . van Waveren, H. (2010). Using adaptation tipping points to prepare for climate change and sea level rise: a case study in the Netherlands. *Wiley Interdisciplinary Reviews: Climate Change*, 1(5), 729-740.

Lynch, K. (1960). *The Image of the City* (pp. 91-117). Cambridge, MA: MIT Press.

MacLean, R. (2011). Venice of the North. Retrieved 01/17, 2013, from <http://blog.goethe.de/meet-the-germans/archives/173-Venice-of-the-North.html>

Maguire, E. A., Burke, T., Phillips, J., & Staunton, H. (1996). Topographical disorientation following unilateral temporal lobe lesions in humans. *Neuropsychologia*, 34(10), 993-1001.

Mansor, M., & Said, I. (2008). Place attachment of residents to green infrastructure network in small towns. *Proceedings of the 9th SENVAR*, 325-340.

McGraw, K. O., & Wong, S. P. (1996). Forming inferences about some intraclass correlation coefficients. *Psychological methods*, 1(1), 30.

Milgram, S. (1976). Psychological maps of Paris. *Environmental psychology : people and their physical settings*, 104-124.

Osmond, H. (1963). What's New in Psychiatric Research. *Mind: psychiatry in general practice*, 275.

Ostroff, C., & Schmitt, N. (1993). Configurations of organizational effectiveness and efficiency. *Academy of management Journal*, 36(6), 1345-1361.

Quaiser-Pohl, C., Lehmann, W., & Eid, M. (2004). The relationship between spatial abilities and representations of large-scale space in children—a structural equation modeling analysis. *Personality and Individual Differences*, 36(1), 95-107.

Raplee, P. (2010). Ghent, Belgium: attractions, tours, and even a time lord. Retrieved 01/16, 2013, from <http://www.offbeattravel.com/ghent-belgium-tours-attractions-activities.html>

Tao, Z., & Zhengnan, Z. (2013). Urban surface water system in coastal areas: A comparative study between Almere and Tianjin Eco-city. *Open Journal of Ecology*, 2013.

**BIO**

Hope H. Rising is a Visiting Professor of Landscape Architecture at the Pennsylvania State University. She holds a PhD in Landscape Architecture, a Master of Landscape Architecture, a Master of Urban Planning, and a Bachelor of Science. Her research investigates The Urban Picturesque and The Attention Restoration Theory as points of departure for adaptive place-making. This research intends to better adapt individuals to a new environment and to help cities more effectively cope with the impacts of climate change and sea level rise.

This research was supported by the University of Oregon, the Taipei Economic and Cultural Office in San Francisco, and the Environmental Research Association. Correspondence concerning this article should be addressed to Hope H. Rising at [hope.rising@psu.edu](mailto:hope.rising@psu.edu)



COUNCIL OF EDUCATORS  
IN LANDSCAPE ARCHITECTURE

*A CELA Conference Presentation*

*Abstract ID: 320*

## **RURAL INTERDISCIPLINARY SERVICE-LEARNING PROJECTS: FRAMEWORKS FOR ENGAGEMENT WITHIN REGIONAL RURAL DEVELOPMENT CENTERS**

### **SLEIPNESS, OLE**

Assistant Professor, Landscape Architecture and Environmental Planning, Utah State University

### **RYAN, KATHLEEN**

Assistant Professor, School of Design and Construction, Washington State University

### **KRIKAC, ROBERT**

Assistant Professor, School of Design and Construction, Washington State University

### **GOMEZ, SUSIE**

Graduate Student, Master of Landscape Architecture and Environmental Planning, Utah State University

### **ABSTRACT**

*In recent decades, design programs have engaged communities' tangible needs through service-learning, civic engagement, and participatory action research. These approaches offer experiential learning opportunities for students and provide services to underserved communities (Lee, 2008). Recognizing these benefits, academic programs employ these models of engagement in their pedagogical approaches at the project, course, or program levels. In the current era of urbanization, rural communities and their landscapes represent an array of large-scale design challenges. While landscape architecture maintains a body of work in the planning, design, and management of large-scale and rural landscapes, allied design disciplines have been reticent to engage in rural projects within the university studio setting to a comparable degree. This paper showcases an alternative focus to the dominant urbanist paradigm by engaging university design programs in rural projects. Using a content analysis of publicly available publications, we identify potential strategic opportunities for the design disciplines located at land-grant institutions within the region of the Western Rural Development Center and recommend ways in which design programs based in all four USDA-funded Regional Rural Community Development Centers can enhance their engagement in rural issues while fulfilling the land-grant missions of their respective institutions.*

### **1.1 Keywords**

Rural, service-learning, interdisciplinary, civic engagement

---

The authors are solely responsible for the content of this technical presentation. The technical presentation does not necessarily reflect the official position of the Council of Educators in Landscape Architecture (CELA), and its printing and distribution does not constitute an endorsement of views which may be expressed. Technical presentations are not subject to the formal peer review process by CELA Track Chair System; therefore, they are not to be presented as peer-reviewed publications. Citation of this work should state that it is from a CELA conference paper. EXAMPLE: Author's Last Name, Initials. 2014. Title of Presentation. CELA Paper No. 14-xxxx. Baltimore, Maryland: CELA. For information about securing permission to reprint or reproduce a technical presentation, please contact CELA at [dsolco@uta.edu](mailto:dsolco@uta.edu) or 817-272-2321.

## **2 INTRODUCTION & BACKGROUND**

What role could design programs housed in land-grant universities play in addressing rural design problems? How can existing university-community partnership frameworks facilitate involvement of the design disciplines in engaging rural issues? This exploratory study evaluates university design programs' involvement in one of the four regionally located USDA-funded Rural Community Development Centers and recommends ways in which the four regional centers can provide an organizing framework for interdisciplinary service-learning endeavors.

### **2.1 Rural Issues as Design Problems**

Rural areas have problems. Due to globalization, shifting demographics, and economic changes precipitated by the decline of natural resource based economic sectors, rural communities experience a unique set of challenges. These challenges include rapid growth and change within natural amenity-rich areas (Howe, McMahon, and Propst, 2012), shifting economic conditions, decline of natural resource extraction employment opportunities, depopulation in many areas, changes in food and energy production, and interdependent relationships between significant public lands and the communities that adjoin them (Winkler et.al, 2007). While these challenges often reflect economic and cultural dimensions (Smith and Krannich, 1998), these challenges are presented in a geographic and spatial context that comprises a built environment (Bartuska and Young, 2007) ripe with design opportunities. However, these challenges are not merely social or economic in nature—rather they are impacted by and manifested in the physical environment in intertwined and multifaceted ways. The spatial dimensions of rural challenges present unique engagement opportunities for the design

disciplines—landscape architecture, interior design, and architecture— particularly those situated at land grant universities.

## **2.2 University Design Response**

Many university design programs have responded to these challenges by offering collaborative models that partner the creative expertise of their faculty and students with community members' local knowledge to improve the physical conditions of rural communities and thereby facilitating positive economic and social change (Angotti, Doble, and Horrigan, 2012). Typically, these endeavors employ a co-design process (Lee, 2008) that collaboratively engages those who will use the space, place, or product of design in the design process itself. This partnership model is in contrast to traditional design models by which designers assume the role of expert and design for, rather than with the client. Relatedly, participatory action research (Reardon, 2000) offers a method to engage community residents and those in the design disciplines with identification and planning for community-defined issues. Participatory action brings all stakeholders together to strategize to solve a community-based problem. While specifics of the process may differ depending on the type of issue being addressed and the context in which engagement occurs, notable examples include the East St. Louis Action Research Project (Reardon, 1998) which involves design students from the University of Illinois in urban issues.

Other notable collaborative models of design engagement in rural settings include the Rural Studio at Auburn University (Hinson, 2007), The Rural Communities Design Initiative at Washington State University, and various extension landscape architecture endeavors such as those at University of Kentucky and Utah State University. Due to the enormity and uniqueness

of rural design challenges, some (Thorbeck, 2013) have even proposed that rural design should be defined as a new and distinct design discipline. While these university initiatives all engage communities with the intention of leveraging the creative resources of faculty and students to address rural needs, these programs are unique in their focus on rural issues. Within most academic design programs, there is much greater interest in engaging urban issues through design. Reflective of national demographic trends and urbanization, most academic design programs are oriented toward urbanism. From the point of view of using design to impact large populations of people in their immediate physical context, their urbanist focus is a laudable and rational response to demographic patterns. However, vibrant urban areas still require functioning rural hinterlands to supply the food, energy, and other natural resources necessary to sustain large urban populations. Furthermore, rural communities provide urban dwellers respite and access to surrounding natural amenity-rich recreational landscapes. Consequently, the physical qualities of rural built environments must be holistically considered as part of an interrelated regional system of human settlements situated on a continuum of urban to rural.

In a parallel thread of activity, the USDA maintains four regional rural development centers housed at land grant universities within each region. Land grant universities within each region have membership within each of the regional rural development centers (see Tables 2-1, 2-2, 2-3, and 2-4). The Western Rural Development Center (WRDC), housed at Utah State University, has 12 member institutions represented by land grant universities in the western region of the United States. The Northeast Regional Center for Rural Development (NRCRR), housed at Pennsylvania State University, Southern Rural Development Center (SRDC) housed at Mississippi State University, and North Central Regional Center for Rural Development (NCRCD) housed at Michigan State University all mirror this organizational model. Tasked



with providing economic and community development guidance to U.S. rural communities, the centers “form a one-stop shop to connect to the nationwide network of land-grant college and university researchers, educators, and practitioners to provide sound information and hands-on, community- level training. The trainings help rural communities make science-based decisions about their community and economic development investments” (WRDC, 2014 p17).

**Table 2-1 Western Rural Development Center and Member Institutions**

<b>WRDC</b>	
American Samoa Community College	University of California
Colorado State University	University of Guam
Montana State University	University of Hawaii
New Mexico State University	University of Idaho
Northern Marianas College	University of Nevada
University of Alaska	University of Wyoming
University of Arizona	Utah State University
University of California	Washington State University

**Table 2-2 Northeast Regional Center for Rural Development and Member Institutions**

<b>NERCRD</b>	
Cornell University	University of Maryland Eastern Shore
Delaware State University	University of Massachusetts
Penn State University	University of New Hampshire
Rutgers University	University of Rhode Island
The University of Maine	University of the District of Columbia
University of Connecticut	University of Vermont
University of Delaware	West Virginia State University
University of Maryland	West Virginia University

**Table 2-3 Southern Rural Development Center and Member Institutions**

<b>SRDC</b>	
Alabama A&M University	Mississippi State University
Auburn University	North Carolina A&T State University
Tuskegee University	Langston University
University of Arkansas	Oklahoma State University
University of Arkansas at Pine Bluff	University of Puerto Rico
Florida A&M University	Clemson University
University of Florida	South Carolina State University
Fort Valley State University	Tennessee State University
University of Georgia	University of Tennessee
Kentucky State University	Prairie View A&M University
University of Kentucky	Texas A&M University

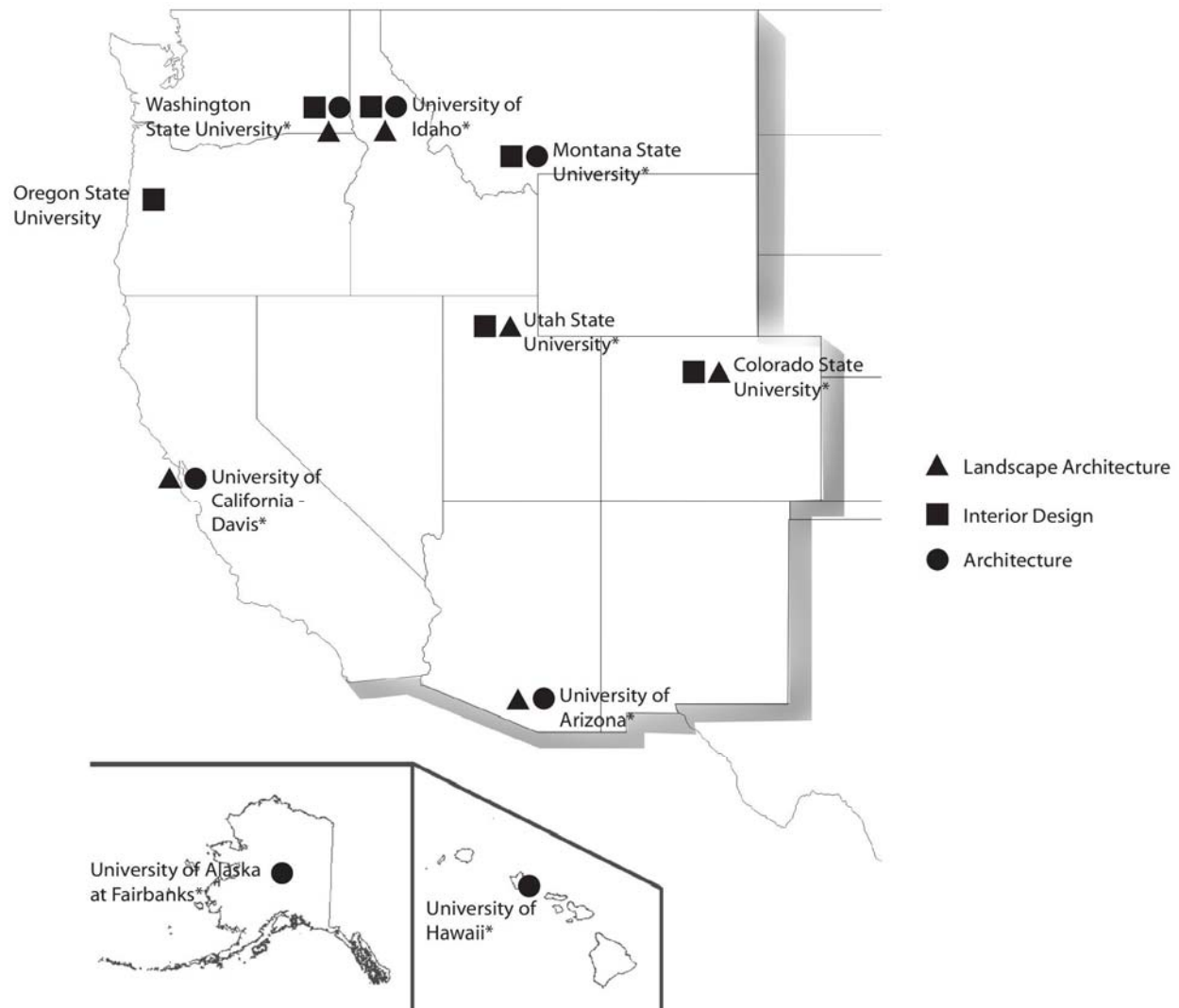
Louisiana State University Southern University Alcorn State University	University of Virgin Islands Virginia State University
--	---

**Table 2-4 North Central Regional Center for Rural Development and Member Institutions**

<b>NCRCRD</b>	
Iowa State University	University of Illinois
Kansas State University	University of Minnesota
Michigan State University	University of Missouri
North Dakota State University	University of Nebraska
The Ohio State University	University of Wisconsin
Purdue University	Lincoln University*
South Dakota State University	Central State University*

\*1890 Land Grant Institutions

Figure 2-1 shows the spatial arrangement of WRDC land grant member institutions that have at least one of the design disciplines. Oregon State University is not a part of the WRDC, but is an 1868 land grant institution. New Mexico State University, University of Wyoming, and University of Nevada at Reno are a part of the WRDC, but are not shown as they do not have a design discipline.



**Figure 2-1 Western Rural Development Center Member Institutions with Design Programs**

Influenced by unique rural dilemmas in the western, southern, north central, and northeast regions, the four Regional Rural Development Centers (RRDCs) are a potential mechanism for connecting design programs at land grant institutions with pressing rural issues within their respective regions. How can university design programs be more engaged in rural contexts? This study identifies ways in which design programs can increase their engagement with rural issues through collaboration with regional rural development centers, with an emphasis on the western region.

### 3 METHODOLOGY

Using a grounded theory approach by design faculty representing landscape architecture, interior design, and architecture—the study used a content analysis of publicly accessible publications of the four regional rural development centers to illuminate regional foci and to identify opportunities corresponding to each of these three design disciplines. The interdisciplinary research team assessed the apparent involvement of design disciplines in the regional development centers based on published materials available on the websites for each of the four regional development centers. Based on the results of this initial assessment, the team identified opportunities for how each of the three design disciplines could engage in the projects described in the examined publications. A preliminary review of the publications representing each of the four RRDCs revealed that while their foci often engage the built environment, design disciplines at each center’s member schools were not overtly engaged within regional development center initiatives.

Initial review of each center—the Western Rural Development Center, Northeast Regional Center for Rural Development, Southern Rural Development Center, and North Central Regional Center for Rural Development—also revealed that each of the centers maintains distinct formatting and content of annual reports, publications, and presentations, resulting in widely varying levels of detail ranging from the number of website visits, listings of board members, and project highlights. Due to the wide variance in level of detail among each center’s publication archives and overlapping thematic content, the research team determined to focus in-depth analysis on one center. We determined that the Western Rural Development Center maintained

the most prolific and extensive collection of online published materials describing its activities and work of contributing institutions.

Due to its relatively high level of detail and thematically organized content, the research team selected the Western Rural Development Center's publication *Rural Connections* for further detailed content analysis. According to the WRDC (n.d.), "*Rural Connections*, the magazine of the Western Rural Development Center, is published to inform the nation on timely research and activities by the West's land-grant institutions and regional/national agencies as it relates to rural development issues in the region. Contributors include researchers, faculty, Extension researchers, specialists and agents, practitioners, and professionals from throughout the West with occasional contributions from outside the region."

### **3.1 Overview of Process**

Archived issues of *Rural Connections* for the previous seven years (see table 3-1) were reviewed and closely examined for initial content themes and the presence of descriptions of the design disciplines—landscape architecture, interior design, and architecture—particularly those housed at WRDC member institutions. Subsequently, each of the 125 articles within these issues of *Rural Connections* was searched for the presence of keywords associated with the three design disciplines. The presence of keywords within an article triggered in-depth analysis of the context surrounding these keywords. This contextual analysis highlighted opportunities for design engagement.

**Table 3-1 Issues of *Rural Connections* and Thematic Content**

Issue	Topical Theme
June 2015	<i>Extension in the West: Team Building</i>
May 2014	<i>Extension's Role in Sustainability</i>
Nov 2013	<i>Immigration</i>
June 2013	<i>Our Energy Future</i>
Jan 2013	<i>Drought and Wildfire in the West</i>
May 2012	<i>Local and Regional Food Systems Boost Local Economies</i>
Sept 2011	<i>The Rural West: Daring to Innovate Job Creation</i>
June 2011	<i>Climate Change Adaptations in the Rural West</i>
Sept 2010	<i>Healthy Communities</i>
May 2010	<i>Water in the Western U.S.</i>
Nov 2009	<i>Food Security in the Western U.S.</i>
April 2009	<i>Creating Sustainable Communities in a Changing America</i>

### 3.2 Initial Content Analysis and Keyword Search

Within each thematic issue of *Rural Connections*, subthemes were mapped out to see where design disciplines would have the most potential. Following this initial thematic mapping, each volume of *Rural Connections* was analyzed for inclusion of keywords associated with the design disciplines. These keywords were extrinsically derived from disciplinary descriptions and definitions by the professional organizations affiliated with each of the design disciplines—landscape architecture, interior design, and architecture. These keywords were subsequently reviewed and augmented with additional keywords as deemed appropriately by the interdisciplinary research team. The resulting list of keywords associated with each of the disciplines was then used in a content analysis of the texts of each volume of *Rural Connections* in order to identify potential projects in which design disciplines could be involved to enhance an existing project or advance its progress in subsequent phases (see Table 3-2).

**Table 3-2 Keywords by Discipline**

Landscape Architecture	Interior Design	Architecture
<b>Landscape architecture</b>	Interior design	Architecture
<b>Landscape</b>	Interior	Façade
<b>Garden</b>	Residence	Office
<b>Exterior</b>	Tenant improvement	Open space
<b>Land</b>	ADA	Downtown
<b>Planning</b>	Accessible	Infrastructure
<b>Land use planning</b>	Space planning	Motel
<b>Parks</b>	Education	Housing
<b>Recreation</b>	Institution	Sports
<b>Site</b>	Multi-family	Industrial
<b>Streetscape</b>	Design*	Design*
<b>Public space</b>	Sustainable*	Sustainable*
<b>Urban design</b>	Adaptive reuse*	Adaptive reuse*
<b>Water resources</b>	Retail*	Retail*
<b>Greenway</b>	Commercial*	Commercial*
<b>Path</b>	Residential*	Residential*
<b>Trail</b>	Building*	Building*
<b>Campground</b>	Transportation*	
<b>Ecology</b>		
<b>Parking</b>		
<b>Storm water</b>		
<b>Pedestrian</b>		
<b>Design*</b>		
<b>Sustainable*</b>		
<b>Transportation*</b>		

\*keywords overlap with at least one of the other design disciplines

### 3.3 Contextual Analysis

Following the content analysis for presence of keywords, the keywords were analyzed in the context of the individual article and thematic volume to illuminate potential design collaboration potential. Through a close reading of the contextual text and imagery, the research team assessed the applicability of the article content to the three design disciplines. These opportunities were rated on a scale ranging from low, medium, and high in terms of the strength of their potential design relationships. Subsequently, the interdisciplinary research team reviewed and corroborated each of the ratings and collectively developed recommendations for how university design disciplines might engage each of the opportunities highlighted in the *Rural Connections* articles. The applicability of design to each reviewed article is presented in

summary table format in this article, along with corresponding discussions of particular design opportunities generated by the interdisciplinary research team.

## 4 RESULTS

### 4.1 Keyword Frequency

Figure 4-1 indicates the relative frequency of keywords associated with each discipline. Of the three design disciplines, landscape architecture keywords were used most frequently, followed by interior design, architecture, and interdisciplinary combinations. These keyword frequencies led to contextual analyses of the articles for potential design opportunities for landscape architecture, interior design, and architecture.

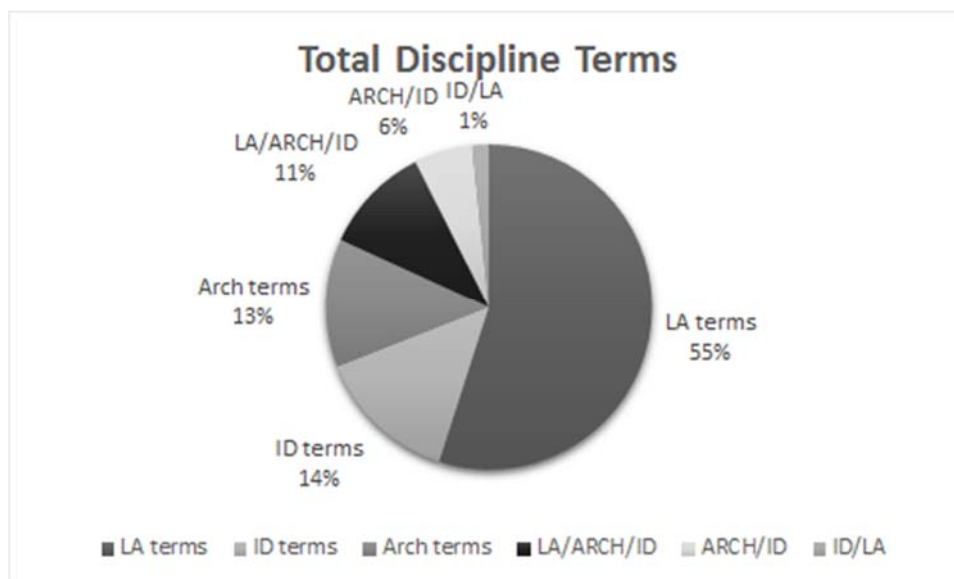


Figure 4-1 Keywords by Discipline

### 4.2 Content Analysis and Design Opportunities by Thematic Issue

Following, are analyses of each of the thematic issues of Rural Connections from June 2015 to April 2009. Within each issue, articles deemed to have particular design relevance are



discussed, followed by a summary table indicating design relevancy for each article within that particular thematic issue.

#### 4.2.1 Extension in the West: Team Building

##### ***Colorado River Basin Agricultural Water Conservation Clearinghouse***

Drought is becoming heightened in the Colorado River Basin and without adaptation, water will eventually be directed away from agriculture to meet other water demands (Plombom, Kallenberger, Waskom, & Smith, 2015). Design disciplines would be integral to solutions, especially in reducing domestic needs that will demand agricultural water be directed to them. These would be in the form water saving strategies, especially in the design of drought resistant landscapes.

##### ***Nevada's Living with Fire Program***

Nevada has a high wildfire risk along the wildland-urban interface but risks can be minimized through building and site design strategies (Smith, Sistare, & Miller, 2015). The described program relies on educating landscape workers, who then share their knowledge on wildfire risk management. Design disciplines can work with authorities to develop strategies that reduce the risk of damage to sites and structures through landscape design, housing design, zoning and codes.

**Table 4-1 Design Opportunities from June 2015 Issue of *Rural Connections***

<b>Rural Connections: June 2015 Extension in the West: Team Building</b>	Landscape Architecture	Interior Design	Architecture
Small Business is Everyone's Business	Low	Low	Low
Exploring Samoan Culture and Food Security	Low	Low	Low
Colorado River Basin Agricultural Water Conservation Clearinghouse	High	Low	Low
Nevada's Living with Fire Program	High	Medium	Medium
Renewable Energy's Role in University Outreach to the Public	Medium	Medium	Medium

#### 4.2.2 Extension's Role in Sustainability

##### ***Extension Sustainability Outreach: Rising to Meet Public Sustainability Demand***

This article discusses sustainability publications, programs, and an Extension Sustainability Summit. During the summit, the article mentions the benefits of educating “local officials and communities in fundamental principles of land use planning and zoning” (Brain, 2014 p4). Design disciplines would be a valuable asset in bring clarity to principles of land use planning and zoning through the ability to provide graphic visualizations of different land use planning and zoning strategies.

##### ***Land Use and Sustainability in the West***

“Extension educators from around the West gathered to present and discuss the relationship of land, air, food, water, and energy” (Apel, 2014 p11). This article focuses on land use and how it engages with sustainability as we face population growth, diminishing water, and climate change. “Extension agents are in a position to facilitate, consult with, and educate stakeholders on land use planning...” (Apel, 2014 p14). Examples of resources for these include GIS technology, mapping, and other web-based collaborative planning tools. The article identifies landscape architects and planners as a collaborative resource for helping extension educators work with these complex issues.

**Table 4-2 Design Opportunities from May 2014 Issue of *Rural Connections***

<b>Rural Connections: May 2014 Extension's Role in Sustainability</b>	Landscape Architecture	Interior Design	Architecture
Rising to Meet Public Sustainability Demand	High	Medium	Medium
The Sustainability Revolution	Low	Low	Low
Land Use and Sustainability in the West	High	Low	Medium
The Imperatives and Challenges of Addressing Climate Risk in Cooperative Extension Communities	Medium	Low	Low
Extension's Role in Improving Water Resource Sustainability	Medium	Low	Medium
Sustainable Food Systems	Low	Low	Low
Energy Extension is Central to Sustainability	Low	Low	Low

### 4.2.3 Immigration

#### ***LIFE (Local and Immigrant Farmer Education) in Hawaii***

Underrepresented agricultural areas need education on responsible and sustainable farming, business, risk management, and environmental protection stewardship. In Hawaii, these are offered through the Local and Immigrant Farmer Education program (LIFE) (Sugano, Fukada, & Swift, 2013). The program in this article was determined to have a high potential for design involvement, particularly if these programs include design disciplines to help educate clients on spatial awareness.

**Table 4-3 Design Opportunities from November 2013 Issue of *Rural Connections***

<b>Rural Connections: November 2013 Immigration</b>	Landscape Architecture	Interior Design	Architecture
The History of Immigration and Demographic Trends in the Western United States	Low	Low	Low
Immigration and Immigration Policy in the West	Low	Low	Low
Rural Latinos: Adaptations and Contributions	Low	Low	Low
Strengthening Latino Small Businesses and Entrepreneurs in Washington: An Overlooked Strategy for Community Economic Development	Low	Low	Low
An Overview of Farm Labor in the United States	Low	Low	Low
The Changing Face of California Agriculture: Identifying Challenges and providing Opportunities for Southeast Asian and other Minority Farmers	Low	Low	Low
LIFE (Local and Immigrant Farmer Education) in Hawaii	Medium	Low	Low
Immigration and Agriculture: What Next?	Low	Low	Low

### 4.2.4 Our Energy Future

#### ***The energy future of rural America.***

The article outlines large-scale multi-dimensional and complex problems dealing with energy scarcity, population growth, and food production amid a changing and urbanizing western

U.S. (Oliver, 2013). Design disciplines have critical roles in addressing these issues, due to their emphasis on systems thinking.

### ***10-Year Energy Vision- Western Governors' Association Energy Initiative***

The article on the Western Governors' Association Energy Initiative describes the array of conventional and renewable energy resources including coal and oil, wind, solar, geothermal, and biomass, and their role in a national energy policy (Herbert, 2013). The topic has great applicability to landscape architecture, particularly in visual analysis work inherent in siting and routing power transmission lines and pipelines.

### ***In the Good Times and the Bad: Shale Gas Development and Local Employment***

Housing shortages in shale gas development areas and the effects of gas infrastructure on landscape aesthetics and property values are described in the article (Weber, 2013). Design disciplines should be integral players in assisting energy development companies and the communities affected by booms to develop strategies to providing worker housing. Potential options include housing that could be quickly constructed, easily relocated, re-purposed, or recycled and sites that could be readily adapted for alternate uses after the boom has passed.

**Table 4-4 Design Opportunities from June 2013 Issue of *Rural Connections***

<b>Rural Connections: June 2013 Our Energy Future</b>	Landscape Architecture	Interior Design	Architecture
The Energy Future of Rural America	Low	Low	Low
10-Year Energy Vision – Western Governor's Association Energy Initiative	Low	High	Low
Energy in a Global World	Low	Low	Low
The Sociology of Greenhouse Gas Emissions: A Brief Overview	Low	Low	Low
Renewable Energy: Implications for Rural Development and Rural Policy in the Intermountain West	Low	Low	Low
Wind Development as 'Sustainable Entrepreneurship'	Low	Low	Low
Woody Biomass Industry in Utah: The Story of the Utah Biomass Resources Group	Low	Medium	Low
In the Good Times and the Bad: Shale Gas Development and Local Employment	Low	Low	Low

#### **4.2.5 Drought and Wildfire in the West**

##### ***Fire and Drought in Paradise- Say it Isn't So, Smokey***

The article describes the relationship between native versus non-native invasive plant species, drought conditions, and wildfire in Hawaii (Cram et al., 2013). Design disciplines, especially landscape architecture would be valuable allies in promoting the planting of native species and illustrating a variety of options for using native species to obtain effects similar to the allure that leads to planting invasive non-native species.

##### ***Community Wildfire Planning as a Tool to Enhance Trust:***

##### ***Case Studies from Western Montana***

This article details the study of wildfire in communities in the Wildland Urban Interface. Results of survey data are directly applicable for designers of residential communities, especially landscape architects and architects (Lachapelle & McCool, 2013). Siting of structures, selection of building materials and vegetation, and perhaps most importantly, areas where development should not be constructed are fundamentally design issues.

##### ***Extension Disaster Education Network Responds to 2012 Drought and Wildfires***

The economic and financial costs of wildfire and other natural disasters are outlined in the article (White, Cain, & Cassel, 2013). The Extension Disaster Education Network (EDEN) would have direct applicability of design, particularly in educational exhibit design.

**Table 4-5 Design Opportunities from January 2013 Issue of *Rural Connections***

<b>Rural Connections: January 2013 Drought and Wildfire in the West</b>	<b>Landscape Architecture</b>	<b>Interior Design</b>	<b>Architecture</b>
Drought in the West: How Governors Address a Slow Moving Disaster	Medium	Medium	Medium
Drought on the Rio Grande	Low	Low	Low
Ranching, Risk, and Resilience During Drought	Low	Low	Low
Helping a Community Develop a Drought Impacts Reporting System	Low	Low	Low
Fire and Drought in Paradise – Say It Isn't So, Smokey	Medium	Low	Low
The Economic Impacts of Large Wildfires	Low	Low	Low
Community Wildfire Planning as a Tool to Enhance Trust: Case Studies from Western Montana	Medium	Medium	Low
Yellowstone National Park and the Summer of Fire	Low	Low	Low
Extension Disaster Education Network Responds to 2012 Drought and Wildfires	Low	High	Low

#### **4.2.6 Local and Regional Food Systems Boost Local Economies**

##### ***A Food Hub Challenge***

Systems thinking, particularly the infrastructure necessary to produce, transport, process, and distribution of food for human consumption is the focus of this article (Merrigan, 2012).

With designers' use of systems thinking—especially landscape architecture and land use suitability analyses—designers are naturally situated to think holistically about food systems.

Also, the physical components of the food infrastructure system—such as gardens, transportation systems, warehouses, and markets—are opportunities for architecture, interior design, and landscape architecture.

##### ***Land Use Planning and Spatial Configuration Benefit Community Agriculture***

Coordination of urban agriculture with recreational and green infrastructure development is the topic of this article by University of Idaho landscape architecture professor, Gary Austin (2012). The topic presents many opportunities for design, particularly in landscape architecture,

planning, and development of underutilized land. While land suitability analyses provide clear opportunities for landscape architecture, interior design and architecture can also play critical roles in the development of urban agricultural systems.

### ***Developing a Healthy Food Hub in Rural Nevada***

Community gardening in the context of public schools, and how the practice of sustainable gardening extends into the greater community are described in detail (Lakes, 2012). Naturally, the design of gardens and associated facilities is an opportunity for landscape architecture and interior design.

### ***Rebuilding Alaska Foodsheds: No shortage of good ideas***

Local food production and local food consumption in Alaska are described in the context of the biophysical challenges of growing food in harsh climates. The authors note “a striking lack of infrastructure for butchering, processing, and marketing the end products” (Gerlach and Loring, 2012 p24), as well as contributions of food infrastructure to communities’ social functioning. The lack of supporting infrastructure is challenging for sustainable food production. While possibly unconventional, the infrastructure for butchering, processing, and marketing food products are clearly design opportunities for interior design and architecture. While design students may not conceive of slaughter houses or other food processing facilities as conventional design projects, these facilities present unique design challenges, particularly in the humane treatment of animals.

**Table 4-6 Design Opportunities from May 2012 Issue of *Rural Connections***

<b>Rural Connections: May 2012 Local and Regional Food Hubs Boost Rural Economies</b>	<b>Landscape Architecture</b>	<b>Interior Design</b>	<b>Architecture</b>
A Food Hub Challenge	Medium	Medium	Medium
Clarifying the Regional Food Hub Concept	Low	Low	Low
Cooperation: The Final Frontier	Low	Low	Low
Economic Implications of Farm to School for a Rural Colorado Community	Low	Low	Low
Land Use Planning and Spatial Configuration Benefit Community Agriculture	High	Medium	High
Developing a Healthy Food Hub in Rural Nevada	High	Medium	Low
Rebuilding Alaska Foodsheds: No Shortage of Good Ideas	Low	Medium	Medium
Growing a Local Food Policy Council	Medium	Low	Low
Pacific Food Hubs: Guam Island-Style	Low	Low	Low
Networks, Food Hubs, and Rural Wealth Creation	Medium	High	High
We Eat Where We Live: The Role of Consumer Co-ops in Local Food Distribution	Low	Medium	Low

#### **4.2.7 The Rural West: Daring to Innovate Job Creation**

##### ***Creating Value for Place-Based Businesses***

Extension economic development advocates for small business clients in a broad range of business models and outcomes (Falen, Gray, Sluder, & Westerndorf, 2011). The authors emphasize that working with small business owners is an organic process. Because of the open co-learning process, extension and small-business owners were able to collaborate. Business models that require physical facilities would benefit from early input from the design disciplines so that they are not caught off-guard by the requirements associated with new construction or renovations.



***Agricultural Tourism and Rural Development— Developing Value-Added Farm and Ranch Resources to Diversify Operations Beyond Agricultural Production***

Evolution of rural agricultural economies from conventional farming to agricultural tourism are described in the article (Burr, 2011). “Agritourism” is identified as providing a rural experience for those living in urban centers. The allure of agritourism relates to urban-dwellers’ desires to have immersive experiences in a rural lifestyle (Phillip, Hunter, & Blackstock, 2010). In their efforts to improve their economic stability, agricultural entrepreneurs participate more heavily in alternative business models. In developing branded products that fit into the gourmet food market, agricultural entrepreneurs provide on-site experiences for tourists, and greatly increase their diversity in product development. Many modifications are necessary to accommodate tourism in existing agricultural operations. Many of these modifications are site and structure issues such as parking, signage, restrooms, and creative ways of illuminating agricultural processes while providing visitors with a positive experience. Consequently, design disciplines should be involved in the early planning stages so that the business plan includes necessary physical modifications.

**Table 4-7 Design Opportunities from September 2011 Issue of *Rural Connections***

<b>Rural Connections: September 2011 Daring to Innovate Job Creation</b>	<b>Landscape Architecture</b>	<b>Interior Design</b>	<b>Architecture</b>
Now is Not the Time for "Business as Usual"			
The New Natural Resource Economy	Low	Low	Low
Agricultural Tourism and Rural Development – Developing Value-Added Farm and Ranch Resources to Diversify Operations Beyond Agricultural Production	High	High	High
Keeping it Local – Towards a Micronesian Production Seal	Low	Low	Low
Creating Value for Place-Based Businesses	High	High	High
Sustainable Rural Development Using the Community Business Matching Process	High	Medium	High
Get on the Bus: Connecting Small Communities on Montana's Hi Line	Low	Low	Low
Rebuilding the Grain Chain: Stories from the Coastal Pacific Northwest	Low	High	High
The Small Business Impact of Telecommunications Policy Restrictions in Rural States	N/A	N/A	N/A
The Digital Economy in the Western U.S.	N/A	N/A	N/A
Small Community Gets Big Broadband	N/A	N/A	N/A
Burning in the Sun	N/A	N/A	N/A

#### **4.2.8 Climate Change Adaptations in the Rural West**

##### ***Assisting Arctic Inhabitants in Responding to a Changing Climate***

The effects of climate-change have already impacted coastal village locations, and promises to impact many economic sectors. Authors (Gamble, Trainor, & Fresco, 2011) identify collaboration efforts between governmental agencies and residents in Alaska as they confront increasingly warmer winters. Design disciplines could be involved in helping plan new communities in danger of becoming submerged or developing strategies to protect existing communities from rising waters. Additionally, the design disciplines could contribute valuable visualization skills during envisioning of new economic opportunities.

**Table 4-8 Design Opportunities from June 2011 Issue of *Rural Connections***

<b>Rural Connections: June 2011 Climate Change Adaptations in the Rural West</b>	<b>Landscape Architecture</b>	<b>Interior Design</b>	<b>Architecture</b>
Finding a Place for Climate Science in the Rural West	High	Low	Low
Classical and Jazz: Two Approaches to Supporting Rural Community Preparation for Climate Change	Low	Low	Low
Food Security Adaptation Planning	High	Medium	Medium
State Fiscal Implications of Climate Change Legislation to Energy-Dependent States	Low	Low	Low
Can Rangeland Carbon Sequestration Help livestock Producers and Rural Economies Adapt to Climate Change	Low	Low	Low
Anaerobic Digestion in the Pacific Northwest	Low	Low	Low
Assisting Arctic Inhabitants in Responding to a Changing Climate	High	Medium	Medium
Climate Change and Family Forest Landowners in the Pacific Northwest: Attitudes and Understanding	Medium	Low	Low
Climate Change and Agriculture in the Pacific Northwest	Low	Low	Low
Multi-State Water and Climate Collaboration in the Pacific Northwest	Low	Low	Low
Building Resiliency from Climate Impacts into Oregon Agricultural Systems: Strategies and Challenges	Low	Low	Low
Planning Agricultural Responses to Climate Change in California	Medium	Low	Low
Split Estate: Benefits and Consequences of Drilling in the Rocky Mountain West	Low	Low	Low

#### **4.2.9 Healthy Communities Improving Health and Well-Being**

##### ***Mental Health Outdoors: the Benefits of Nature***

Biophilia and Kaplan's Attention Restoration Theory (ART) are described under recommendations for improving mental health. This project defines the classic use of ART and biophilia to support environmental psychology benefits of nature (Beil, 2010). The benefits of the natural environment can be supported through both activities outside, and through development of architectural and interior design that support humans intrinsic desire for exposure to the natural environment. There are multiple opportunities for the design disciplines to develop opportunities in the built environment—including site and interior design—that promote human interactions with nature and views to the outdoors.

### ***Poverty Reduction Project Increases Social and Natural Capital***

The author (Kollock, 2010) describes a project that involved community members making improvements through community clean-up efforts. These efforts were successful in bringing residents together in a dedicated effort to improve the townscape. The successes encouraged the community to tackle larger design issues in town, including a marina. The design disciplines could partner with the community restoration efforts to upgrade local site resources including a marina and community garden.

### ***Investigating Places for Active Recreation in Rural North Carolina Communities***

The authors reported a lack of clarity in standards about what features to include in local recreational areas (Henderson, Edwards, Casper, Bocarro, & Floyd, 2010). This provides a clear opportunity for the design disciplines, particularly landscape architecture. The importance of forming partnerships was a main finding from rural recreation directors in order to achieve goals. Design disciplines are typically structured to function best in partnership arrangements as a part of a team assembled to address issues related to the built environment. Design disciplines' involvement early in the process, using participatory or co-design methods, would help identify a range of options for recreational opportunities to assist stakeholder decision-making on standards of recreation provisioning.

### ***Health, Economy and Community: USDA Forest Service Managers' Perspectives on Sustainable Outdoor Recreation***

This project primarily focused on a survey of USDA Forest Service managers on "perceptions of sustainable recreation" (Bricker, Winter, & Schultz, 2010 p39). The authors

identified that Forest managers indicated that residents should be involved in the process most felt that there was poor communication between the Forest Service and residents. Design disciplines are versed in participatory or co-design methods that include stakeholder input early in the development process, and provide graphic and written communication material that is easily disseminated to garner public feedback.

### ***Community Recreation and Healthy Living in Rural Settings***

This project addressed Louv's (2008) "nature-deficit disorder" regarding rural children and the extended transportation they experience, and distance limitations to bicycling or walking. The project refers to the "recreation road - a rural route to planning" as an important resource for rural community planning related to recreation activities (Goodwin, 2010 p45). The author notes that many recreation planners do not gather input from recreational users and recommend ways of generating greater involvement from residents. Design disciplines are well versed in participatory or co-design methods that would be a more effective way to involve regional stakeholders what forms of recreation are most desirable.

### ***Thermus aquaticus and You: Biodiversity, Human Health, and the Interpretive Challenge***

Interpretation of scientific principles behind geologic factors at Yellowstone National Park are described in the article. The authors identify the importance of employing "creative approaches to interpretation" (Dustin, Schwab, & Bricker, 2010 p50). Integrating design disciplines in the methods and strategies of interpretation of science for the general public is a natural avenue for design engagement. The design disciplines have experience in partnering with experts to

interpret complex issues in interpretive centers, museums and other public educational venues. Development of graphic visuals and texts would tell the story of these complex scientific concepts to a general audience.

**Table 4-9 Design Opportunities from September 2010 Issue of *Rural Connections***

<b>Rural Connections: September 2010 Healthy Communities Improving Health and Well-Being</b>	Landscape Architecture	Interior Design	Architecture
The Forest as Nature's Health Service			
Mental Health Outdoors: The Benefits of Nature	high	Medium	Medium
Rural Health and Rural Landscapes: An Ecological Approach to the Study of Obesity	High	low	low
The Obesity Research Prevention and Evaluation of Intervention Effectiveness in Native North Americans	Low	Low	Low
Poverty Reduction Project Increases Social and Natural Capital	high	High	High
Investigating Places for Active Recreation in Rural North Carolina Communities	high	Medium	Medium
Health, Economy and Community: USDA Forest Service Managers' Perspectives on Sustainable Outdoor Recreation	high	Low	Low
Community Recreation and Healthy Living in Rural Settings	high	Medium	Medium
Thermus aquaticus and You: Biodiversity, Human Health, and the Interpretive Challenge	High	High	High

#### **4.2.10 Water in the Western U.S.: Is there enough to meet the region's needs?**

##### ***Constructed Wetlands for Wastewater Treatment as Landscape***

##### ***Amenities in Rural Communities***

According to the article, small communities with populations fewer than 2,000 residents can use biological treatment systems for sewage, using a wetland or in tanks in a greenhouse (Austin, 2010). These constructed wetlands can not only treat wastewater but also provide public amenities. The article describes in detail how constructed wetlands are implemented and conceptually illustrates how their principles could be applied. Opportunities for the design

disciplines are apparent in the design of constructed wetlands as well as in the educational illustration of their benefits.

**Table 4-10 Design Opportunities from May 2010 Issue of *Rural Connections***

<b><i>Rural Connections: May 2010 Water in the Western United States</i></b>	<b><i>Landscape Architecture</i></b>	<b><i>Interior Design</i></b>	<b><i>Architecture</i></b>
<i>River of Empire</i>	Low	Low	Low
<i>The Future of Western Water Law: Will Prior Appropriation Survive Changing Priorities in Western Water Use?</i>	Low	Low	Low
<i>Is the Failure to Acknowledge Tribal Interests Fueling the Water Crisis?</i>	Low	Low	Low
<i>The Klamath Solution: Certainty for Farmers and Electricity Consumers</i>	Low	Low	Low
<i>Measuring the Sustainability of Western Water Systems</i>	Low	Low	Low
<i>Time and Nature</i>	Low	Low	Low
<i>Western Households' Water Values, Knowledge and preference for meeting Future Scarcity: What is the Public's View of Western Water Issues?</i>	Low	Low	Low
<i>Hydrological Impacts of Traditional Community Irrigation Systems in New Mexico</i>	Low	Low	Low
<i>Constructed Wetlands for Wastewater treatment as Landscape Amenities in Rural Communities</i>	High	Low	Low
<i>Tunnel Vision in the Central Valley: Narrow regulatory Focus Dries up Western Rural Communities</i>	Low	Low	Low
<i>Farmer Participation in Temporary irrigation Forbearance: Portfolio Risk Management</i>	Low	Low	Low
<i>Water Policy Innovations and Challenges in Arizona</i>	Low	Low	Low
<i>Thinking as a Watershed</i>	Low	Low	Low
<i>Agricultural Water conservation Clearinghouse: Addressing Agricultural Water Security in a Changing Climate</i>	Low	Low	Low

#### **4.2.11 Food Security in the Western U.S.**

##### ***Food Insecurity and Stress Among Children in the Western U.S.***

According the authors (Gunderson & Garasky, 2009), children from rural areas are at greater risk for obesity due to the stress brought on by poor quality housing. Housing stressors

including having to live in low quality accommodations, having to move in with others, and being sent away from parents are correlated with issues of food insecurity. Addressing the design problem of how to provide quality housing, for seasonal and year-round workforces are ripe design problems for both architecture and interior design.

**Table 4-11 Design Opportunities from November 2009 Issue of *Rural Connections***

<b>Rural Connections: November 2009 Food Security in the Western United States</b>	Landscape Architecture	Interior Design	Architecture
Food Insecurity in Western States	Low	Low	Low
Poverty Amidst Plenty – Understanding Farm Worker (In)Security in California	Low	Low	Low
Rural Collaboration Works to Build Higher Skill Levels in Hopes of Attracting Better Jobs	Low	Low	Low
Food Insecurity and Stress Among Children in the Western U.S.	Medium	High	High
Farm to School: The Health of the Next Generation	Low	Low	Low
Marketing Healthy Foods in a Rural Convenience Store Setting	Low	Low	Low
Real Food: It takes a year to Write an In-Sean Real Food Cookbook	Low	Low	Low
Food Security in the Western U.S. and Pacific Territories	Low	Low	Low
Sunshine Barley: Ready to Grow	Low	Low	Low
Grow! Food Security with a Community Garden	Low	Low	Low
Wasatch Front CSA Collective: Growing Possibilities & Seeking Local Solutions to Food Production	Low	Low	Low
Advocating Native Bee Pollination Services on U.S. Farms	Low	Low	Low

#### **4.2.12 Creating Sustainable Communities in a Changing America**

##### ***Providing Workforce Housing While Preserving Natural Character in***

##### ***New Hampshire Communities***

Legislation in New Hampshire requires the provision of workforce housing in communities that is affordable and conserves land (Gagne, 2009). This legislation requires that communities consider affordable housing while preserving the natural character of the land.



Design disciplines have a clear role in teams collaborating to achieve these complex goals through design of housing and impacted landscapes. The topic provides clear opportunities for design engagement with rural stakeholders as well as interdisciplinary collaboration opportunities for university design programs.

### ***Local Decision Maker***

A program developed by Purdue University assists planning decision makers in developing comprehensive plans. It uses assessment of existing conditions, development of a vision for the future, development and comparison of development strategies, and selection and implementation of the preferred strategies. The program is focused on informing and integrating natural resource and economic development decisions (Farnsworth, Kumar, & Nolan, 2009). The database and planning workshop programs described would benefit from design discipline input to assist the community planners using this service in more clearly visioning their design opportunities. This could include the development of solutions with various options that can be easily assessed for impacts on quality of life as well as economic impact.

**Table 4-12 Design Opportunities from April 2009 Issue of *Rural Connections***

<b>Rural Connections: April 2009 Creating Sustainable Communities in a Changing America</b>	<b>Landscape Architecture</b>	<b>Interior Design</b>	<b>Architecture</b>
An Entrepreneur Based Economy	Low	Low	Low
Her Seat at the Table	Low	Low	Low
Diversity, Change and Social Justice	Low	Low	Low
Extension's Entrepreneurs and Their Communities Website – An Emerging Resource for Community and Economic Development Professionals	Low	Low	Low
Exploring Unintended Consequences in Community Development	Low	Low	Low
Providing Workforce Housing While Preserving Natural Character in New Hampshire Communities	High	Medium	High
Economic Growth vs. Economic Development: Are you Taking the Time to measure Changes Impacting Quality of Life?	Low	Low	Low
LULA Leadership Training in Land Use and Community Conflict	Low	Low	Low
Local Decision Maker	High	Medium	Medium
Conservation: A Path to Community Sustainability	Low	Low	Low
The Tourism Connection: Contributing to Sustainable Community Development in the 21 <sup>st</sup> Century	Low	Low	Low
Shalom Farm: Growing Food, Family and Friends	Low	Low	Low
Rural Farmers' Markets: Challenges and Strategies	Low	Low	Low
Earth, Wind, Fire: Preparing for Bio-Energy Opportunities in Wisconsin	Low	Low	Low
Environmental Education: Forests for Today and Tomorrow	Low	Low	Low
Youth Civic Engagement Through the Youth City Council Program	Low	Low	Low
Listening to the Experts: A Report on What We Heard	Low	Low	Low

## 5 IMPLICATIONS & DISCUSSION

A plethora of opportunities for design engagement can be found within the analyzed issues of *Rural Connections*. Many of the rural dilemmas engaged by the RRDCs—and embodied within the rural built environment—would benefit from the creative and technical expertise of landscape architects, interior designers, and architects. Within these rural dilemmas,

there are opportunities for design to be involved in the project described, either immediately or in subsequent steps that further develop the project in the future.

Given their expertise in collaboration, visualization, and design thinking, one may wonder why design programs housed within member land-grant institutions are not more visibly involved in these featured projects? One possible explanation resides in previous research indicating the persistence of challenges for engaging in interdisciplinary rural design engagement in an era of urbanization. As urbanism draws research funding and faculty interest, one may reason that rural design issues seem less alluring in academic design cultures, even in programs housed within land-grant universities. Or perhaps those engaged in rural issues from a non-design discipline perspective have not considered how design thinking could be leveraged within a project that may seem unconventional—or even inappropriate—for landscape architects, interior designers, or architects.

As universities place greater emphasis on funded research, design disciplines are swept along in this new paradigm, particularly programs that are situated within academic units with disciplines that traditionally achieve high productivity in traditional peer reviewed research and funding outputs. The four regional centers are a potential organizing framework for design disciplines to engage in nationally recognized and funded research and engagement priorities. For landscape architecture, interior design, and architecture to fully engage human settlement on a regional scale, rural built environments must be holistically considered as part of an interrelated system of design challenges. While rural settings present an intriguing array of opportunities for design thinking, the greatest challenge may be to shift conventional conceptions of what designers do.

## 6 REFERENCES

- Apel, M. (2014). Land Use and sustainability in the West. *Rural Connections*, 8(2), 11-16.
- Angotti, T., Doble, C., & Horrigan, P. (Eds.). (2012). *Service-learning in design and planning: Educating at the boundaries*. New Village Press.
- Austin, G. (2010). Constructed wetlands for wastewater treatment and as landscape amenities in rural communities. *Rural Connections*, 4(2), 37-40.
- Austin, G. (2012). Land use planning and spatial configuration benefit community agriculture. *Rural Connections*, 6(2), 17-20.
- Bartuska, T. J., & Young, G. (2007). *The built environment: definition and scope* (pp. 3-14). Wiley, Hoboken, NJ, USA.
- Beil, K. (2010). Mental health outdoors: The benefits of nature. *Rural Connections*, 5(1), 11-14.
- Brain, R. (2014). Extension sustainability outreach: Rising to meet public sustainability demand. *Rural Connections*, 8(2), 3-6.
- Bricker, K., Winter, P., & Schultz, J. (2010). Health, economy and community: USDA Forest Service managers' perspectives on sustainable outdoor recreation. *Rural Connections*, 5(1), 38-42.
- Burr, S. (2011). Agricultural tourism and rural development—developing value-added farm and ranch resources to diversify operations beyond agricultural production. *Rural Connections*, 6(1), 11-14.
- Cram, D., Cordell, S., Friday, J., Giardina, C., Litton, C., Moller, E., & Pickett, E. (2013). Fire and drought in paradise—say it isn't so, Smokey. *Rural Connections*, 7(1), 19-22.

- Dustin, D., Schwab, K., & Bricker, K. (2010). *Thermus aquaticus* and you: Biodiversity, human health and the interpretive challenge. *Rural Connections*, 5(1), 47-50.
- Farnsworth, R., Kumar, I., & Nolan, C. (2009). Local decision maker - plan your future. *Rural Connections*, 3(2), 21-24.
- Gagne, M. (2009). Providing workforce housing while preserving natural character in New Hampshire communities. *Rural Connections*, 3(2), 14-16.
- Gamble, B., Trainor, S., & Fresco, N. (2011). Assisting Arctic inhabitants in responding to a changing climate. *Rural Connections*, 5(2), 39-44.
- Falen, C., C. Gray, L. Sluder, & S. Westendorf. (2011). Creating Value for Place Based Business. *Rural Connections*, 6(1), 17-20.
- Garcia-Pabon, J. (2013). Strengthening Latino small businesses and entrepreneurs in Washington: An overlooked strategy for community economic development. *Rural Connections*, 8(1), 17-20.
- Gerlach, S., & Loring, P. (2012). Rebuilding Alaska foodsheds: No shortage of good ideas. *Rural Connections*, 6(2), 23-24.
- Goodwin, S. (2010). Community recreation and healthy living in rural settings. *Rural Connections*, 5(1), 43-46.
- Gunderson, C. & Garasky, S. (2009). Food insecurity and stress among children in the western U.S. *Rural Connections*, 4(1), 13-14.
- Henderson, K., Edwards, M., Casper, J., Bocarro, J., & Floyd, M. (2010). Investigating places for active recreation in rural North Carolina communities. *Rural Connections*, 5(1), 33-37.
- Herbert, G. (2013). 10-year energy vision - Western Governors' Association energy initiative. *Rural Connections*, 7(2), 7-10.

- Hinson, D. (2007). Design as research. *Journal of Architectural Education*, 61(1), 23-26.
- Howe, J., McMahon, E. T., & Propst, L. (2012). *Balancing nature and commerce in gateway communities*. Island Press.
- Kollock, D. (2010). Poverty reduction project increases social and natural capital. *Rural Connections*, 5(1), 29-32.
- Lachapelle, P., & McCool, S. (2013). Community wildfire planning as a tool to enhance trust: Case studies from western Montana. *Rural Connections*, 7(1), 27-30.
- Lakes, Q. (2012). Developing a healthy food hub in rural Nevada. *Rural Connections*, 6(2), 21-22.
- Lee, Y. (2008). Design participation tactics: the challenges and new roles for designers in the co-design process. *Co-Design*, 4(1), 31-50.
- Louv, R. (2008). *Last child in the woods: Saving our children from nature-deficit disorder*. Algonquin Books.
- Merrigan, K. (2012). Introduction- A Food Hub Challenge. *Rural Connections*, 6(2), 5-7.
- Oliver, L. (2013). The energy future of rural America. *Rural Connections*, 7(2), 3-6.
- Phillip, S., Hunter, C., & Blackstock, K. (2010). A typology for defining agritourism. *Tourism Management*, 31(6), 754-758.
- Plombon, E., Kallenberger, J., Waskom, R., & Smith, M. (2015). Colorado River Basin Agricultural Water Conservation Clearinghouse. *Rural Connections*, 9(1), 13-16.
- Reardon, K. M. (2000). An experiential approach to creating an effective community-university partnership: The East St. Louis Action Research Project. *Cityscape*, 59-74.
- Reardon, K. M. (1998). Enhancing the capacity of community-based organizations in East St. Louis. *Journal of planning Education and Research*, 17(4), 323-333.

- Smith, E., Sistare, S., & Miller, E. (2015). Nevada's Living with Fire Program. *Rural Connections*, 9(1), 17-20.
- Smith, M. D., & Krannich, R. S. (1998). Tourism dependence and resident attitudes. *Annals of Tourism Research*, 25(4), 783-802.
- Sugano, J., Fukuda, S., & Swift, S. (2013). LIFE (local and immigrant farmer education) in Hawaii. *Rural Connections*, 8(1), 29-32.
- Thorbeck, D. (2013). *Rural design: a new design discipline*. Routledge.
- Weber, J. (2013). In the good times and the bad: Shale gas development and local employment. *Rural Connections*, 7(2), 33-36.
- White, V., Cain, S., & Cassel, E. (2013). Extension disaster education network responds to 2012 drought and wildfires. *Rural Connections*, 7(1), 35-38.
- Winkler, R., Field, D. R., Luloff, A. E., Krannich, R. S., & Williams, T. (2007). Social Landscapes of the Inter-Mountain West: A Comparison of 'Old West' and 'New West' Communities. *Rural Sociology*, 72(3), 478-501.
- WRDC. (n.d.). <http://wrdc.usu.edu/hlm/rural-connections> Accessed 12:46 pm January 8, 2016.
- WRDC.
- WRDC. (2014). *Western Rural Development Center 2014 Annual Report*. WRDC.

## BIO

### **Ole Sleipness, PhD, Utah State University**

Ole Sleipness is an assistant professor in the department of Landscape Architecture and Environmental Planning at Utah State University. His research interests focus on issues of rural community growth and change, the intersection between public and private lands, and community engagement within these contexts. He holds a PhD in Environmental Design and Planning and Master of City and Regional Planning from Clemson University, and a BLA from Washington State University.

### **Kathleen Ryan, Washington State University**

Kathleen Ryan is an assistant professor in the School of Design and Construction at Washington State University. Her research interests focus on issues of interdisciplinary design education, community engagement, and design innovation through trans-disciplinary collaboration. She holds a MS in Interior

Design from Washington State University and and BS in Design and Environmental Analysis from Cornell University.

**Robert Krikac, Washington State University**

Robert Krikac is an associate professor in the School of Design and Construction at Washington State University. His research interests focus on design communication through graphic representation, history and pedagogy of drawing, and engagement of rural community needs with the creative resources of university design programs. His professional background includes both architectural and interior design projects.

**Susie Gomez, Utah State University**

Susie Gomez is a graduate student in the Master of Landscape Architecture program at Utah State University. She holds a BLA from Washington State University. Her research interests focus on commemorative landscapes, particularly those which constitute the Manhattan Project National Historical Park.



## **READING THE CULTURAL SPECIFICITIES OF THE IRAQI MARSH ARABS FROM THEIR LANDSCAPE**

**AL-TAMEEMI, RASHA**

PhD candidate, University of Cincinnati

### **ABSTRACT**

*Iraqi Marshlands are irregular clusters of small islands constructed by alternating layers of reed mats and layers of mud that dredged from the marsh bottom to constitute one of the most strange and fascinating regions of the world. Marshlands in Iraq are one of the most intriguing environments for scholars because of their long history dating back to the Sumerian civilization. Until 1992, Iraqi marshes remained relatively unknown to the general public but widely known to archeologists and scholars of Mesopotamia. The Marshlands are one of the most ancient centers of dwelling in Iraqi's history, and scholars like Sam Kubba and Abbas Jamali suggest they are the cradle of Sumerian civilization.*

*However ancient history is not what brought the region to public discourses involving the environment in recent years. Iraqi marshlands have captured the attention of the international community from their depletion by the dictator Saddam Hussein in 1992 as retribution to the inhabitants who opposed his government. The draining of the swamps led to severe environmental, social, and economic consequences for local residents.*

*Saddam Hussein drained away the organizational way of life of the inhabitants of the Marshlands that is organically inseparable from the environment. The Marshlands is a woven society in reeds, a place where people and nature are closely bound together in symbiotic sustainable relationships.*

### **1.1 Keywords**

Iraqi Marshlands, Marsh Arabs, Landscape settlements, and cultural specificity

## **2 INTRODUCTION**

Iraqi Marshlands are irregular clusters of small islands constructed by alternating layers of reed mats and layers of mud that dredged from the marsh bottom to constitute one of the most strange and fascinating regions of the world. Marshlands in Iraq are one of the most intriguing

environments for scholars because of their long history dating back to the Sumerian civilization<sup>1</sup>. Until 1992, Iraqi marshes remained relatively unknown to the general public but widely known to archeologists and scholars of Mesopotamia. The Marshlands are one of the most ancient centers of dwelling in Iraqi's history, and scholars like Sam Kubba and Abbas Jamali suggest they are the cradle of Sumerian civilization.<sup>2</sup>

However ancient history is not what brought the region to public discourses involving the environment in recent years. Iraqi marshlands have captured the attention of the international community from their depletion by the dictator Saddam Hussein in 1992 as retribution to the inhabitants who he thought opposed his government. The draining of the swamps led to severe environmental, social, and economic consequences for local residents. According to a UN report, from 4 December 1991 to 18 January 1992, the Iraqi military attacked the Marsh Arabs, killing hundreds of them. In addition, an enormous number of animals, birds and buffalo were killed. Indubitably, we cannot forget the marsh water, which filled with toxic chemicals as a result of the oppressive campaign.<sup>3</sup> Sam Kubba and Abbas Jamali wrote that:

Most ecological scientists agree that the destruction of the marshes was a catastrophe of global significance and certainly one of the most grievous ecological crimes of the twentieth century. Saddam Hussein deliberately and methodically managed to drain, reportedly poison with herbicides and desiccate the lush wetlands that were home to over 450,000 Marsh Arabs, as well

---

<sup>1</sup> According to the study of Ochsenschlager, Edward L. in *Iraq's Marsh Arabs in the Garden of Eden*, the archaeological record shows discovered that by the middle 4<sup>th</sup> millennium BC Sumerians occupied this area and built the oldest cities in the world. By the end of 3<sup>rd</sup> millennium BC this land knew the first empire in the history for Akkadians. Then in the following two thousand years, the empires of Babylonians, Assyrians, Persians, Greeks, and Parthians controlled this region chronologically.<sup>1</sup> Many scholars made geographical attempts to discover the location of "Garden of Eden" or the earthly paradise where Adam and Eve are thought lived before, and those scholars have tendency to consider the site of Sumer civilization as Eden. That's because the word "Eden" is derived from the Sumerian word "edinu" which referred to field, plain, or depression.

<sup>2</sup> Sam A, A. Kubba and Abbas F. Jamali. *The Iraqi Marshlands and the Marsh Arabs. The Ma' dan, their Culture and their Environment*, ed., Kubba (Reading, UK: Ithaca Press, 2011), 2.

<sup>3</sup> Nicholson, Emma, and Peter Clark. *The Iraqi Marshlands* (London: Politico's Publishing, 2002), 74.

as a crucial stopover for birds migrating from Europe to Africa. The Marshlands also served a critical function to the entire Arabian Gulf filtering out toxins while contributing organic matters to fish breeding in the region.<sup>4</sup>



Left: Before the draining by Saddam in 1992



Right: After the draining

Figure1: shows the Iraqi marshes before and after draining, one of many of Saddam Hussein's crimes that has led to an ecological, cultural, and humanitarian disaster in one of the oldest natural environments in the world.

From the observations of Kubba and Jamali, it is not an over-statement to suggest that Saddam Hussein drained away the organizational way of life of the inhabitants of the Marshlands that is organically inseparable from the environment. The Marshlands is a woven society in reeds, a place where people and nature are closely bound together. The houses and crafts of the inhabitants of the Marshlands are evidence of how the people and their environment maintain

---

<sup>4</sup> Sam A, A. Kubba and Abbas F. Jamali. *The Iraqi Marshlands and the Marsh Arabs*, 15.

symbiotic sustainable relationships the architectural tectonics of the people as “woven societies in reeds.”

My goal in this paper is to examine how the socio-organization and the landscapes of the Marshlands fashioned certain cultural specific knowledge of the Marsh Arabs in a sustainable manner. To that effect I explore three related questions before summarizing the main ideas in the paper in the conclusion. The three questions are as follows:

(a) The Context/Setting and the People: How is the concept of landscape used in this essay to explain the cultural specificity(ies) of the inhabitants of the Iraqi Marshlands?

(b) Landscape, Settlement Patterns, and Dwellings: How did the landscape influence the settlement patterns and the dwellings of the Marsh Arabs?

(c ) Landscape, Economic Activities, and Social Organization: How does landscape support sustainable economic activities and social organizations of the Marsh Arabs?

It is understood that these questions have cultural, social, economic, political and environmental implications. The complexity of the questions requires fleshing out the diverse related meanings of landscape and how it is used in this context.

### **1. The Context/Setting and the People**

(a) How is the concept of landscape used in this essay to explore the cultural specificity(ies) of the inhabitants of the Iraqi Marshlands?

There are three related parts to the first question. It inquires about the setting/landscape, the people, and the cultural specific ways by which we know the inhabitants of the area. It is difficult to write about the landscape without considering the people, and likewise we cannot write about

the people without considering the landscape where they dwell. I will begin with the setting that is often identified in history as Mesopotamia.

The Mesopotamian Marshland, which is located in south of Iraq, is one of the largest wetlands in the world. It is where the cradle of Sumerian civilization began more than 5000 years ago, and it is known as “The Garden of Eden”.<sup>5</sup> The Iraqi Marshlands have many areas such as Al-Chibayish Marsh, Al-Hammar Marsh, and Al-Huawiyza Marsh. Al-Chibayish Marsh is considered one of the biggest marshlands in the south of Iraq and it has an area of about 2600 square kilometers. The word *chibayish* refers to the heap of reeds. The reed houses that are built on *chibayish* are known as *sarifa*. All these formulate the remains of civilization that floats on water.<sup>6</sup>

If we want to understand the people and their settlements in the Iraqi Marshes, certain words that are frequently used to describe them and their lands should be explained. We will begin with the most commonly used term, Marsh. The word *Marsh* generally refers to a type of low-lying land that receives frequent or continuous flooding. The word *wetlands* can refer to both marshes and swamps. But there are subtle differences between marshes and swamps. Marshes tend to be shallower, have less open water, and have herbaceous plants, especially grasses, reeds and sedges. Swamps, on the other hand, tend to be deeper, have greater areas of open water, trees and shrubs are the dominant vegetation.<sup>7</sup> While the word *Hawr* is the Arabic term for marsh, which is commonly used in Iraq to refer to a wide shallow lake that has abundant reeds, rushes and vegetation.<sup>8</sup> The term *hawr* (singular of *ahwaar*) is not modern; it has been traced to the Sumerian

---

<sup>5</sup> Sam A, A. Kubba and Abbas F. Jamali *The Iraqi marshlands and the Marsh Arabs*, Foreword.

<sup>6</sup> Ibrahim, Mohammad Hammoud. *Iraqi Marshlands and the Garden of Eden*, (Almothaqaf Newspaper, No.1136, 11<sup>th</sup> of Aug., 2009).(Arabic)

<sup>7</sup> *Al-Mawrid Dictionary*. (Dar al-Ilm lil Malayin Press, Beirut, Lebanon, 2010), 561.

<sup>8</sup> Susa, Ahmad. *History of Mesopotamian Civilization*, Part 1. (Baghdad, 1983), 405-407.

times when it was mentioned in the ancient stories of the Flood.<sup>9</sup> Because of this, *hawr* is thought to predate the use of Arabic in the area. Moreover, Arabic dictionaries give more than one definition of the term, including flooding and receding lake of reedy waters and thickets.<sup>10</sup>

In the next part of the first question, I would like to examine who are the people?

It is believed that the civilization of the Marsh can be traced to the period of Gilgamesh who mentioned the Marshlands in his Epic during his search for the secret herb that can extend life to eternity. Sumerians, followed by the Akkadians, Babylonians, Persians, Nabataeans, Romans and Arabs, have settled in the same area.<sup>11</sup> There is a diversity of religions and ethnicities in Iraq in general and in the marshlands in particular from the past until the present time. The main religious groups are Muslims, Sabians and Jews. The existence of many shrines from diverse religious is the evidence that the Marsh Arabs community lived in harmony with different ethnicities and religions in this area. From the 90s till now, the number of Jews and Sabians has dwindled as a result of the political and social situation in Iraq generally, and in the marshlands in particular.<sup>12</sup>

However, the predominant race in the marshes has been the Arabs. Some of the Arab tribes came to the region prior to the Islamic conquest, and some during and after it. In the 1950s, anthropologists who studying in al-Chubayish, one of the Iraqi marshes, identified two main racial and cultural influences among the marsh dwellers: The Eastern Group and the Western Group.<sup>13</sup> The Eastern Group includes the Ma'dan, Albu Muhammad and other tribes in the Tigris marshes; they had links with their eastern neighbors, the inhabitants of Iran, through migration and

---

<sup>9</sup> Ryan, William and Walter Pitman. *Noah's Flood: The New Scientific Discoveries about the Event which Changed History*, (New York : Simon & Schuster, 1998), 240

<sup>10</sup> Thuainy, Ali. *Architectural Reed in Sothern of Iraq*, (Al-Madda Cultural Journal: architecture and art, No.137, 10th of Aug. 2004).(Arabic)

<sup>11</sup> Sam Kubba, *The Iraqi Marshlands and the Marsh Arabs*,8.

<sup>12</sup> Al-Khayoun, Rasheed. *Religions and Sects in Iraq*( Al-Kamel Verlage, Koln, Ggermany, 2003), 36,104. And Kubba, *The Iraqi marshlands and the Marsh Arabs the Ma'dan, their culture and the environment*. 34-35.

<sup>13</sup> Salim, Shakir Mustafa. *Marsh Dwellers of the Euphrates Delta* (University of London, Athlone Press, 1962), 8.

intermarriage. The Western Group comprises the non-Ma'dan Euphrates Marsh Arabs, and they had links with the Bedouin tribes of the Arabian Peninsula in the way of immigration and intermarriage.<sup>14</sup> In general, there are three names used in describing the inhabitants of Iraqi marshlands: *Ma'dan*, *Marsh Arabs*, and *marsh dwellers*.

The word *Ma'dan* has conflicting meanings. The Marsh Arabs believe that the word '*Ma'dan*' is derived from "Ma'aidi" which means opponent (opposition), and another opinion suggests that it derives from "Mou'adat" which is the Arabic word for hostility and antagonism. Those who support the latter theory believe that British forces promoted the use of this word to demean the marshlands people who fiercely opposed them when they arrived to occupy Iraq in the early twentieth century.<sup>15</sup> The other interpretation of the term *Ma'dan* describes people of the marshes who depend on breeding water buffalo and selling its products in their livelihoods. The *Ma'dan*'s women sell the animal products in the markets and they enjoy almost freedom of movement, in contrast to other Arab tribes that prohibit their women from going out to sell or buy things in the market. This is one of the great distinctions between the *Ma'dan* and other groups. Also, *Ma'dan* never settled in one place; they moved constantly within the boundaries of their tribes and the artificial islands.<sup>16</sup>

*Marsh Arabs* defines the people who live in the marshland. Their natural surroundings influence their social, cultural and economic activities like Desert Arabs due to the migration from the Arabian Peninsula to the marshlands. Their customs, traditions, and values differentiate them from other societies and shape their way of life. Their economic activities are based on cutting and

---

<sup>14</sup> Al-Jubouri, Mahdi Sahar. *Sothern Iraqi Marshlands between rehabilitation and drying* (Essay submitted to Al-Rafidain Center for Strategic Studies and Research, 26<sup>th</sup> of Jul. 2011), (Arabic).

<sup>15</sup> Salim, Shakir Mustafa. *Marsh Dwellers of the Euphrates Delta*, 9.

<sup>16</sup> Mustafa, Salwan Mohammad Ali. *The Economic, Architectural and Social Characteristics of the Marshland* (Sada al-Ahwar Magazine, year II, issue 5, Dhi Qar University, July 2008), 18-20.

processing reed, fishing, and bird hunting. Moreover, the term ‘Marsh Arabs’ is used specifically to describe tribes that do not breed buffalo and do not give their women the freedom of movement, in contrast to the *Ma’dan* who do that.<sup>17</sup>

*Marsh Dwellers* refer to the population who live in the marshlands; they have their own social values, habits, and traditions. This term is used interchangeably with the term *Marsh Arabs*, but it has more geographical and environmental connotations to indicate the natural, social and cultural impact on the inhabitants of marshes.<sup>18</sup>

## 2. The Landscape, Settlement Patterns, and Dwellings of Marsh Arabs

(b) How does landscape influence the settlement patterns and the social organization of the society of the Marsh Arabs?

There are different types of settlements in the Iraqi Marshlands depending on the nature of the marshes such as the surface, weather conditions, types of vegetation and water quality. In addition, some sections flood and ebb seasonally, creating another variable to habitation. The first type is **Settlements on the Edges of the Marshes**. They are built on areas of high ground at the edges of the marshes and called *salaf* or villages, while they are called *nazl* in the Euphrates marshes. Each village consists of between 100 and 300 small huts, depending on the location and the density of population. Villages are found close to the banks of rivers. Each village has one or more guest houses (*mudhif*) from which the clan’s affairs are run. The settlements on the Edges of

---

<sup>17</sup> Ibid.

<sup>18</sup> Mustafa, Salwan. *The Economic, Architectural and Social Characteristics of the Marshland*, 18-20.



the Marshes tend to be larger in size than other types of settlement in the marshes. In these settings, the homes are almost made of mud and brick, due to their proximity to urban areas.<sup>19</sup>



Figure 2: show settlement on the edge of the marshes

The second category is **Settlements on Natural Islands** where marshes become a number of islands in water areas. The people who live on natural islands tend to breed water buffalo, and marsh Arabs call these islands *ishan*. These islands sit about 3m above the water level, and they are apparent during dry season, while some of them are flooded during the wet season. The small islands consist of 30-40 huts made of reed or rushes, while larger islands could reach 500 huts.<sup>20</sup>

---

<sup>19</sup> Salim, Shakir Mustafa. *Marsh Dwellers of the Euphrates Delta*, 23- 24.

<sup>20</sup> Jadran, Abd Al-Zahara T. *The Pollution of Marshland's Water: A Survey of the water of hwar Abu-Zark* (Unpublished Graduation Project of Diploma in Arabic, The Higher Institute of Urban and Regional Planning: University of Baghdad, 2010), 36-37.



Figure 3: show Settlements on Natural Islands

A third distinction, **Settlements on Permanent Artificial Islands**, consists of small man-made islands which float on the surface of the water and on which marsh dwellers build their homes. They are created because of the lack of dry land especially during the wet season, and due to the flooding of natural islands. Artificial islands are called *Chibasha* and consist of several layers of reeds and rushes, interspersed with layers of mud. Then, the islands are compressed together and stabilized with stakes. This process is continued until an adequate height is reached and the artificial island becomes solid. Homes on *Chibasha* are made from reeds and rushes, and each *Chibasha* has between 15 and 25 houses.<sup>21</sup>

---

<sup>21</sup> Ibid.



Figure 4: show settlement on permanent artificial Island

Finally, **Mobile Artificial Island Settlements** which are called *dibin* or *dubun*. They consist of a base of reeds, rushes, and soil that form floating platforms like rafts. Each one of them holds one hut and several water buffalo. They are used by water buffalo breeders as temporary homes which can be pushed from one place to another.<sup>22</sup>

The varieties of dwellings types in the marshes differ according to the construction material, location of the houses, and their purpose. In general, most dwellings are made of reed. Types of marsh dwellings include:

(1) **Sarifa**—plural Sara'if—is considered to be one of the oldest and most common types of dwelling and is constructed from reeds and rushes. Each *Sarifa* has the same structure and appearance: a rectangular shape with a curved roof, covering an area of about 25 m<sup>2</sup>.<sup>23</sup>

<sup>22</sup> Jadran, Abd Al-Zahara T. *The Pollution of Marshland's Water*, 36-37.

<sup>23</sup> Al-Safi, Haider Shoman. *Al-Ma'dan is the Origin of the civilization* (Research Submitted to the Research Center of Marshes: University of Dhi Qar; in Arabic)  
[http://www.iraker.dk/index.php?option=com\\_content&task=view&id=6359&Itemid=99](http://www.iraker.dk/index.php?option=com_content&task=view&id=6359&Itemid=99)



Figure 5: shows Sarifa

(2) *Hut* is similar to the sara'if, but its walls are made of mud rather than reed. It is considered to be one of the simplest types of dwelling in the marshes, and it has a rectangular or square shape with a curved roof. Huts are not built in the marsh. They are found on riverbanks and at the edges of the marshes where flooding is less common.<sup>24</sup>




---

<sup>24</sup> Ibid.

Figure 6: shows Hut

(3) The third type is *Sitra*, which is used to describe a house that is made of reeds and mud to keep animals. It is generally found next to family's house, and sometimes there is no separating wall between the two.<sup>25</sup>



Figure 7: shows Sitra

(4) Finally, the most famous and important type is the guesthouse, or *Al-mudhif*. This is one of the major cultural and social phenomena of the marshes. It cannot be considered just a house; rather it is a place used to receive guests and hold meetings. *Al-mudhif* belongs to the tribe's leader, who is known (sheikh), and the whole village is responsible for the building process.<sup>26</sup> The sheikh's guest house (*mudhif*) in the marshland is an arched building made of reeds, built higher and more detailed

<sup>25</sup> Al-Safi, Haider Shoman. *Al-Ma'dan is the Origin of the civilization*.

<sup>26</sup> Salah Abu Suhair, *Iraqi Guest House is the aesthetics of Sumerian art and the gate of generosity* (AlWilaia Cultural Foundation, 2013; in Arabic) <http://alwilaia.com/index.php/3039/مقالات-وابحاث/html>)



than the other dwellings in the area to display the architectural creativity and building skills that go back more than six thousand years.<sup>27</sup>



Figure 8-1: shows the exterior of Al-mudhif



Figure 8-2: shows the interior of Al-mudhif

All the preceding discussions on the settlements and dwellings of the Marsh Arabs are related to what Rapoport mentions about the physical arrangement of setting which guides,

---

<sup>27</sup> Alwan, Walid Abdul-Amir. *Iraqi's Marshlands: Eden Again* (Report Submitted to the Environmental Tourism, Issue 18, July-August, 2005), 107-111.

facilitates, and modifies social interaction. Also it is related to Rapoport's explanation that physical elements in the landscape can be indicators of social characteristics and behavior.<sup>28</sup>

Carl Sauer, founder of the Berkeley School of Geography, declared that landscape is the cultural expression that includes the cultural changes and development of each society as an exposition of human experiences. Included in his statements is the merger of culture and time in landscape results in various forms of population, housing structures, land usage, and ways of communication.<sup>29</sup> There are scholars who describe landscape as the physical interpretation of human needs to use and defend lands; others saw landscape as the symbolic interpretation of construction of cultural specificity. Correspondingly, landscape expresses cultural specificity of both people and their built environment.<sup>30</sup> From this point of view, the dialectic relationship between human and landscape (people and places) is not just physical, but it is spatial, social, and political characteristics of people's life that gives power to their place and built environment. People and places shape a continuous collaborative relationship.<sup>31</sup>

Jeremy Foster refers to Tim Ingold's recognition of landscape as material phenomenon that reflects the impact of practice and activity over time. He also distinguishes between landscape as visual impression and landscape as a form of continuous lived experience through participation and cooperation.<sup>32</sup> Landscape is the linkage between nation and nature that has figurative and literal meaning and stems from the connection between the character of the culture of particular people and character of particular area that people inhabit.<sup>33</sup> Landscaping becomes a marker that indicates

---

<sup>28</sup> Rapoport, Amos, *The meaning of the built environment*, 98.

<sup>29</sup> Thurston, Tina L., *Landscapes of Power, Landscapes of Conflict, State Formation in the South Scandinavian Iron Age*, (New York: Kluwer Academic/Publishers, 2001) 29.

<sup>30</sup> Ibid., 40.

<sup>31</sup> Ibid., 31.

<sup>32</sup> Foster, Jeremy. *Washed with sun: landscape and the making of white South Africa* (University of Pittsburgh Press, 2008), 84.

<sup>33</sup> Darby, Wendy Joy. *Landscape and Identity: Geographies of Nation and Class in England* (Berg, 2000), 82.

special areas of social importance, interaction, and meeting, that physically defines the most important public space in the urban fabric.<sup>34</sup>

John L. Motloch states in his book *Introduction to Landscape Design*, 2001 that “landscapes are experienced through space and time and express the history of ecological and cultural processes that created them”<sup>35</sup>. Also Motloch defines cultural landscapes as “systematically bound through culturally significant, nonverbal communication with a high degree of association meaning to native people. So, they are records of people, who they are and who they aspire to be.”<sup>36</sup> Motloch also explained about ten different perspectives of landscape. These perspectives are worthy of examination here because each category defines an aspect of the Marsh Arab environment that was drained.

**1-Landscape as nature:** This is the first definition provided by Motloch and it advocates preserving human nature without intervention. However this view isolates people from nature, and it is the exact opposite of Saddam’s punitive handwork in the Marshlands. Saddam’s draining of the region waged war against nature with the express purpose of destroying the habitat that sustained the people. **2- Landscape as habitat:** This view explains landscape as a home for people; it is a place where interaction and work on the land increases its productivity and sustains the environment. This view connects people to the environment. **3- Landscape as artifact:** This view looks at landscape as man-made-land that comprehensively either enhances or dominates nature. This view has many problems because its implementation can cause conflicts when people claim the landscape. **4- Landscape as system:** There is the view that landscape consists of

---

<sup>34</sup> Rapoport, Amos, *The meaning of the built environment*, 121.

<sup>35</sup> Motloch, John L. *Introduction to Landscape Design* (Austin, Texas: John Wiley & Son, 2001), 123.

<sup>36</sup> Ibid, 345.



subsystems and elements that express and integrate with the whole system. This view engages humans with the ecological system to promote long term well-being and productivity, this perspective is the contrast of landscape as artifact. 5- **Landscape as problem:** There is the view point that landscape situations should be corrected due to environmental pollution, crowded urban areas, spreading slums and so on. This view requires functional, infrastructural, and behavioral interventions to solve the problem through effective landscape design. 6- **Landscape as wealth studies** land as a territory owned by people and has economic value that can be measured by the market. This view represents capitalism which adapts materialistic opinion and exploits the environment. 7- **Landscape as ideology** interprets landscape as the physical expression of the culture that integrates values, symbols, beliefs, and dreams which people are capable of encoding and decoding its meaning. 8- **Landscape as history** examines the cumulative historical record of nature and people's activities that signifies the meaning and gestures for many generations in the contexts. It is the spatial temporal mosaic that connects people with land. 9- **Landscape as place** focuses on the gestalt view rather than on the elements that give the place the association to be remembered over time. This view concentrates on the integration of people and environment to give the multiple expressions and influences. 10. **Landscape as aesthetic** focuses on the visual aspects of landscape in favor of reflective aspects rather experiential because it looks to landscape as an object isolated from human behavior.

Motloch's ten definitions agree with Rapoport's proposition that "cultural landscapes are the result of many artifacts grouped together in particular relationship, and also the result of individual's decisions, which suggests the presence of shared schemata among particular groups. So, this landscape conveys meaning in term of various forms of cand can be

read”.<sup>37</sup>Correspondingly, landscape is not only the geographical meaning of the physical surroundings, but also the whole image of social, material, cultural, and symbolic issues.

### **(3-1) Landscape, Economic Activities, and Social Organization**

(c) How does landscape support sustainable economic activities and social organizations of the Marsh Arabs?

We took time to explain the ecology of the Marshes in the beginning of this paper. The ecology of the marshlands affects all aspects of activities of Marsh Arabs, especially, economic activities and social organizations. Economic activities include crop production, animal husbandry, bird hunting, and local industries: weaving of reed mats.<sup>38</sup> In the agricultural field, **Crop Production** is the main activity for a high percentage of Marsh Arabs. They plant rice around the Tigris and Euphrates rivers, in addition to other crops like corn, wheat and barley. Also, watermelons, melons and cucumbers, tomatoes are also grown, as are dates.<sup>39</sup>

**Animal Husbandry** constitutes the main source of income for the Marsh Arabs. Animal production can be varied depending on the type of activity practiced: **water buffalo breeding** is the most common activity in the marshes, and it was one of the principle activities since the Sumerian. And the Marsh Arabs who breed buffalo are called Ma’dan. Water buffalo provide the marsh dwellers with milk and its derivatives, as well as meat. **Fishing** and **Bird Hunting** are important contributors to the economic well-being of the Marshlands. The environment protects the birds during their migrating from northern Europe, Central Asia, and the Russian when they

---

<sup>37</sup> Rapoport, Amos, *The meaning of the built environment*, 137.

<sup>38</sup> Ibrahim, Mohammad Hammoud. *The Role of Culture and Education in the Development of the Marshland People’s Life*.

<sup>39</sup> Kubba, Sam A. *The Iraqi marshlands and the Marsh Arabs*, 91-92.

are escaping the cold during the winter. So, the reeds and brushes provide good nesting grounds for those birds.<sup>40</sup>

**Local Industries** in the marshes are based on manual labor that depends on the raw materials found in this environment while some of the industries need mechanical methods at certain stages of production. Local industries can be categorized as: **Reed Cutting**, **Mat Weaving** and **Boat-Building** from reeds known as (*mash-huf*) which is the most important form of transportation in the marshes. *Al-mash-huf* is small canoe that can easily be maneuvered through the reeds. It is made of wood and coated with bitumen on the outside. The boats are multifunctional: they are used for transporting people, goods, and also for hunting and selling products.<sup>41</sup>

### **(3-2) Landscape as a Mnemonic: A Cultural Specific Social Organizing Medium in Al-Mudhif**

There are a lot of connections between landscape and cultural specificity due to the concept that all societies shape their landscape and subsequently the people are characterized by their landscape. People and landscape are reflections of each other. All these factors integrate with traditions, beliefs, values and culture that have been expressed in the ways of belonging to that society, community, or tribe.<sup>42</sup>

The mnemonic function of environment is to evoke appropriate behaviors, emotions and interpretations that are constituted by contexts. Thus, environment plays the role of the mnemonic which reminds people of appropriate behavior within space and time. The information can be encoded by environment, and then needs to be decoded. So, the environment has to be culturally

---

<sup>40</sup> Alwan, Walid Abdul-Amir. Iraqi's Marshlands: Eden Again . Report Submitted to the Environmental Tourism, Issue 18, July-August, 2005.

<sup>41</sup> Kubba, Sam. *The Iraqi marshlands and the Marsh Arabs*, 54-61.

<sup>42</sup> Benson, John F. and Maggie, H. Roe. *Landscape and Sustainability*, ed., John Benson and Maggie Roe (London: Spon Press, 2000), 66.

specific to let information be decoded easily.<sup>43</sup> In addition, Rapoport writes “culture-specific system assumes that there is analogy between kinesic behavior and language. So, nonverbal behavior may be as culture bound as linguistic behavior”<sup>44</sup> Culture specific is similar to emblem which has a precise meaning understood by all members of a group (residents) which is used for messages like the symbolic gestures have specific verbal translations. So, different groups have different culture specificities which are part of individual lexicon.<sup>45</sup>

Al-Mudhif, the most important house type in the Iraqi Marshlands, has social role that should be understood in its cultural specificity. The door of *al-mudhif* is always open, as a symbol of generosity and welcome. There is a spiritual and emotional connection between marsh Arabs and *al-mudhif*. Marsh Arabs are invited to *al-mudhif* through the sound made by the striking of coffee beans in the mortar. This ringing sound alerts the people who are nearby the guesthouse to come and serve them the coffee. It is also an indication that a case needs to be solved or a particular event requires discussion. Inside *al-mudhif*, everyone has to behave politely, use proper words, and be honest, because lies will not be permitted. The men of the marshes go into the guesthouse with their formal costume, which includes the abaya, with the kaffiyah and headband on their head.<sup>46</sup> So, the context influences social interaction, and the social context plays an important role in interpersonal interaction.<sup>47</sup> There is a clear system of seating inside *al-mudhif* according to the social position of each person. So, people of high status and prestigious people, such as the sheikh, sit in the prime position in the guesthouse, which is distinguished with luxury rugs and pillows. In

---

<sup>43</sup> Rapoport, Amos. *The meaning of the built environment*, 80.

<sup>44</sup> Ibid, 101.

<sup>45</sup> Ibid, 103-104.

<sup>46</sup> Suhair, Salah Abu. "Iraqi Guesthouse is the aesthetics of Sumerian art and the gate of generosity." *Alwilaia Cultural Foundation*. July 1, 2013. <http://alwilaia.com/index.php/>

<sup>47</sup> Rapoport, Amos, *The meaning of the built environment*, 100.

the winter, this place is located in the middle of *al-mudhif*, in front of the fireplace where the coffee is prepared. In the summer, this place is located near one of the side walls. Because of this system, one can infer the importance and the social position of any man in the clan according to his place inside *al-mudhif*.<sup>48</sup>



Figure 9: shows how space as mnemonic teaching medium that shapes cultural specificity of Marsh Arabs.

According to Rapoport, the setting of the environment has an important role in the process of enculturation, especially the impact of marshlands on their inhabitants.<sup>49</sup> He says "The environment imposes an order, a way of classification, the learning of certain systems, behavior, and acceptance of social demands. Then we would expect different enculturation processes and results."<sup>50</sup> So, in the marshlands, people in the communities learn the norms and traditions of tribal laws and obey them. Rapoport describes the environment as the teaching medium, once learned, it becomes a mnemonic device reminding one of appropriate behavior"<sup>51</sup> So, here the whole

<sup>48</sup> Suhair, Salah Abu. "Iraqi Guesthouse is the aesthetics of Sumerian art and the gate of generosity."

<sup>49</sup> Rapoport, Amos, *The meaning of the built environment*, 66.

<sup>50</sup> Ibid, 67.

<sup>51</sup> Ibid.

landscape plays an effective role to encode meaning in traditional societies in order to represent ethnicity and cultural specificity for a group of people and put them in social space which depends on the cultural context.<sup>52</sup> The uniqueness of this particular geography is that it not only ‘reminds’ one of appropriate behavior, but in some cases it dictates or enforces it.



Figure 10: The meaning of the space is derived from what happens in the space

## Conclusion

The marshes that once covered up to 20,000 square kilometers in the 1960s shrank to less than 2,000 square kilometers and reduced to one-tenth of their 1960 size after Saddam waged war in. The draining almost took away the lives and livelihoods of people.<sup>53</sup>

After the fall of Saddam's regime in 2003, the marshlands have been restored through the efforts of many local and global experts and organizations. Azzam Alwash, an Iraqi-American engineer who has a decade of service to the marshlands and the founder of the nonprofit organization *Nature Iraq*, works with a team of global experts and local marsh dwellers to break

<sup>52</sup> Ibid., 71.

<sup>53</sup> Yuan, Joanne. "Iraq's First National Park: A Story of Destruction and Restoration in the Mesopotamian Marshlands." Circle of blue. September 4, 2013. <http://www.circleofblue.org/waternews/2013/world/iraqs-first-national-park-a-story-of-destruction-and-restoration-in-the-mesopotamian-marshlands/>.

Saddam's dykes and canals in order to restore the Marshlands. The team also worked to integrate marsh management into local agricultural and fishing practices. Roughly, 90,000 of the marsh Arabs, who fled during Saddam's oppressive regime have returned to live in their native marshland. The Basra reed warbler and the Iraq babbler, two bird species that live almost exclusively in Iraq's marshes, have also returned. Azzam Alwash writes "Strangely enough, this is one of the few cases where war has resulted in environmental healing. The re-creation of the marshes is literally like the rising of a phoenix from the ashes of destruction. In a sense, it is a symbol of the restoration of Iraq as a whole."<sup>54</sup>

Landscape shows architectural relations for social class, gender, and race imposed by powerful institutions. It mediates the socio-spatial and political differences between governmental controls and place. Landscape is the cultural product of any given society; it embodies their perspective and evokes the way of their life as part of the built environment that synchronizes space and time.<sup>55</sup> It is important to study the meanings of environment within cultural systems, and how different environments can communicate to people and how to use or behave in a particular setting. For that reason, Rapoport states that the setting of environment has important role in the process of enculturation. So lifestyles encode information that is culturally learned to symbolize various meanings and values.<sup>56</sup> In aquatic areas like the marshlands, water is the main component of their built environment and their roads are waterways. So, if they want to go anywhere or even visit their neighbor, the canoe (*mash-huf*) is the only form of transportation. Their children learn how to swim

---

<sup>54</sup> Ibid.

<sup>55</sup> Thurston, Tina L., *Landscapes of Power, Landscapes of Conflict*, 16-17

<sup>56</sup> Rapoport, Amos. *The meaning of the built environment*, 66.

in the same time they learn how to walk; and most of the kids know how to catch the oar as it is one of their hands or feet.<sup>57</sup>

James Morris, director of the Baruch Institute for Marine and Coastal Science and the university's expert on Iraqi marsh restoration, says "The culture there, the Marsh Arabs, were an example of the most sustainable society that I know of, in that they were a more or less self-contained community that lived off of the resources they had available and didn't need a lot of external resources; they depended on those reeds."<sup>58</sup>

---

<sup>57</sup> Al-Ahmed, Mohammed Dawood. Iraqi Marshlands: Civilization of 5000 Years Returns Back (Beatona Magazine, No.136, 2013).(Arabic)  
[http://www.beatona.net/CMS/index.php?option=com\\_content&view=article&id=1181&lang=ar&Itemid=84](http://www.beatona.net/CMS/index.php?option=com_content&view=article&id=1181&lang=ar&Itemid=84)

<sup>58</sup> Malek, Alia. "Can Iraq's lost marshes be restored?" Aljazera America. July 13, 2014.  
<http://america.aljazeera.com/articles/2014/7/13/restoring-iraqs-lostmarshes.html>.



## Bibliography

1. Al-Ahmed, Mohammed Dawood. *Iraqi Marshlands: Civilization of 5000 Years Returns Back*. Beatona Magazine, No.136, 2013. (Arabic).  
<http://www.beatona.net/CMS/index.php>
2. Al-Jubouri, Mahdi Sahar. *Sothern Iraqi Marshlands between rehabilitation and drying*. Essay submitted to Al-Rafidain Center for Strategic Studies and Research, 26<sup>th</sup> of Jul. 2011, (Arabic).
3. Al-Khayoun, Rasheed. *Religions and Sects in Iraq*. Al-Kamel Verlage, Koln, Ggermany, 2003.
4. *Al-Mawrid Dictionary*. Dar al-Ilm lil Malayin Press, Beirut, Lebanon, 2010.
5. Al-Safi, Haider Shoman. *Al-Ma'dan is the Origin of the civilization*. Research Submitted to the Research Center of Marshes: University of Dhi Qar. (Arabic)  
<http://www.iraker.dk/index.php>
6. Alwan, Walid Abdul-Amir. *Iraqi's Marshlands: Eden Again* . Report Subbmitted to the Environmental Tourism, Issue 18, July-August, 2005.
7. Benson, John F. and Maggie, H. Roe. *Landscape and Sustainability*. Edited by John Benson and Msggie Roe. London: Spon Press, 2000.
8. Darby, Wendy Joy. *Landscape and Identity: Geographies of Nation and Class in England*. Berg, 2000.
9. Foster, Jeremy. *Washed with sun: landscape and the making of white South Africa*. University of Pittsburgh Press, 2008.
10. Ibrahim, Mohammad Hammoud. *Iraqi Marshlands and the Garden of Eden*, Almothaqaf Newspaper, No.1136, 11<sup>th</sup> of Aug., 2009, (Arabic)

11. Ibrahim, Mohammad Hammoud. *The Role of Culture and Education in the Development of the Marshland People's Life*. Sada al-Ahwar Magazine, year I, issue 2, Dhi Qar University, April 2007. (Arabic).
12. Jadran, Abd Al-Zahara T. *The Pollution of Marshland's Water: A Survey of the water of hwar Abu-Zark*. Unpublished Graduation Project of Diploma in Arabic, The Higher Institute of Urban and Regional Planning: University of Baghdad, 2010.
13. Malek, Alia. "Can Iraq's lost marshes be restored?". Aljazeera America. July 13, 2014.  
<http://america.aljazeera.com/articles/2014/7/13/restoring-iraqs-lostmarshes.html>.
14. Motloch, John L. *Introduction to Landscape Design*. Austin, Texas: John Wiley & Sons, 2001.
15. Mustafa, Salwan Mohammad Ali. *The Economic, Architectural and Social Characteristics of the Marshland*. Sada al-Ahwar Magazine, year II, issue 5, Dhi Qar University, July 2008.
16. Nicholson, Emma, and Peter Clark. *The Iraqi Marshlands*. London: Politico's Publishing, 2002.
17. Rapoport, Amos. *The meaning of the built environment: a nonverbal communication approach*. Beverly Hills: Sage Publications, 1982.
18. Ryan, William and Walter Pitman. *Noah's Flood: The New Scientific Discoveries about the Event which Changed History*. New York : Simon & Schuster, 1998.
19. Salim, Shakir Mustafa. *Marsh Dwellers of the Euphrates Delta*. University of London: The Athlone Press.

20. Sam Kubba, Abbas F. Jamali, and Sam Kubba. *The Iraqi Marshlands and the Marsh Arabs. The Ma'dan, their Culture and their Environment*. Edited by Sam Kubba. UK: Ithaca Press, 2011.
21. Suhair, Salah Abu. "Iraqi Guesthouse is the aesthetics of Sumerian art and the gate of generosity." Alwilaia Cultural Foundation. July 1, 2013. <http://alwilaia.com/index.php>
22. *Support for Environmental Mangment of the Iraqi Marshlands 2004-2009*. United Nation Environmental Programme, 2009.
23. Susa, Ahmad. *History of Mesopotamian Civilization*, Part 1. Baghdad, 1983.
24. Thuainy, Ali. *Architectural Reed in Sothern of Iraq*, Al-Madda Cultural Journal: architecture and art, No.137, 10th of Aug. 2004, (Arabic)
25. Thurston, Tina L., *Landscapes of Power, Landscapes of Conflict*, State Formation in the South Scandinavian Iron Age. New Yourk: Kluwer Academic/Publishers, 2001.
26. Yuan, Joanne. "Iraq's First National Park: A Story of Destruction and Restoration in the Mesopotamian Marshlands." Circle of blue. September 4, 2013.  
<http://www.circleofblue.org/waternews/2013/world/iraqs-first-national-park-a-story-of-destruction-and-restoration-in-the-mesopotamian-marshlands/>.

## BIO

Rashaia, Al-Tameemi is a PhD. student at the University of Cincinnati. I have B.Sc. and M.Sc in Architecture from the University of Technology/ Baghdad-Iraq. I was assistant lecturer at University of Technology / Department of Architecture, Baghdad, Iraq from August 2008 to April 2013. I occupied the position of Rapporteur of scientific committee (2009-2011) and Committee Member of summer training (2011) at University of Technology/ Department of Architecture, Baghdad- Iraq. I have published two researches (Graphic Techniques for Developing Creativity in Architectural Design; published in The Iraqi Journal of Architecture; 2008.) and (Sculpture and Contemporary Architecture; published in The Iraqi Journal of Architecture; 2010.). Recently, present a paper at Humanities Graduate Conference at Taft Research Center/ University of Cincinnati (March 2015)

**Learning Outcomes:**

1- The Context/Setting of Iraqi Marshlands explains the cultural specificity of their inhabitants Marsh Arabs.

2- The landscape and settlement patterns of Iraqi Marshlands influence the shape and type of dwellings of the Marsh Arabs.

3- The landscape of Iraqi Marshlands supports the economic activities and acts as mnemonic in the social organization of the Marsh Arabs.

## **DESIGN AND EDUCATION OF UNDERGRADUATE LANDSCAPE ARCHITECTURE'S CURRICULUM IN THE UNIVERSITY OF DAMMAM**

**AL-SULBI, ALI OMAR M.**

Assistant Professor, University of Dammam, Kingdom of Saudi Arabia

### **ABSTRACT**

*Landscape Architecture (LA) Department has established at the University of Dammam (UoD) as a supporting department in 1975. It offered LA necessary courses for the students of the college of Architecture and Planning, who were graduated as architects with special emphasis in either Landscape Architecture or Urban Planning. In 1985, the department has become an academic department offering Master Degree in Landscape Architecture (MLA), followed by approval the Bachelor Degree Program (BSLA) in 1992 to overcome the gap of the country's requirements for professionals in landscape architecture. Since 2001, the program has gone through continuous reviews. The recent has introduced in 2010 to align the outcomes with market requirement in the LA graduates which revealed the adoption of new approach for education of LA in the Kingdom of Saudi Arabia (KSA). It has been developed to build basic knowledge in a vertically accumulated approach through theoretical courses on various topics of LA according to the emphasis theme of each Design Studio. This method shows great improvement in the students' performances as the average GPA of graduated patches gradually improved. Moreover, their acquired knowledge and technical skills are logically applied to solve the design problem and satisfy the field market requirements.*

*The process of the curricular review included sending it to stakeholders and international reviewers, then presented to focus groups of academic professionals and stakeholder after addressing the received comments.*

*This Study tries to explore the BSLA curriculum design and the way of educating it in order to graduate fully skilled professional landscape Architects who are able to design, implement and manage landscape projects that vary in scales and contexts.*

### **1.1 Keywords**

University of Dammam, vertically accumulated approach, LA curriculum design and education, curriculum review.

## **2 THE LANDSCAPE ARCHITECTURE PROGRAM: HISTORICAL BACKGROUND**

After the 1970s economic boom, the KSA has witnessed massive urban development

clearly appeared in and around the main economic centers. Such development gave rise to

environmental awareness and resources conservation as results of serious acceleration and augmentation of environmental degradation processes.

Accordingly, tow KSA universities have initiated landscape architecture programs within the created colleges for Architecture and planning in 1975, which become the first in the Middle East. Their aim was to graduate professionals who able – with application of adequate knowledge and appropriate designs to control misuse and abuse of environmental resources as well as regulate the rapid, uncontrolled growth of urban centres.

Both universities [King Abdulaziz University (KAU) in Jeddah and King Faisal University (recently the University of Dammam (UoD)) in Dammam consulted Rice University in the United States of America that developed an adapted program (known as Rice Program) applied by each university on its own way. The KAU applied Rice program into three years core program plus three years of emphasis on majors of architecture (ARCH); urban and regional planning (URPL); and landscape architecture (LA). On the other side, the UoD application of the Rice program was slightly different. Applicant taught a core architectural program for three years and then completed two more years in emphasis track of urban and regional planning; landscape architecture; or continue the architectural program. The difference between the two adaptations is that: the graduates of the KAU is specialised in one of the three majors while those of the UoD graduated as architects with emphasis on one of the two majors.

At the beginning, this was sufficient to bridge the gap and balance the driving forces of development and urban growth on one side, and environment and natural resources conservation on the other side. However, the UoD college of Architecture and Planning has initiated a Master Degree Program in LA in 1985 for those who wanted to develop their carriers in landscape

professions as academic or practitioners. Since 1985, the LA department has become an academic department offering an MLA as second degree and supporting a college for required LA courses. The UoD landscape architecture programs continued the same approach until early 1990s when the Second Gulf War resulted in significant environmental damages and necessitated an urgent need to more specialized programs in the fields of built environment and urban design issues.

## **2.1 Development of the BSLA curriculum**

In 1992, the college of Architecture and Planning - after a thorough review of its program - approved the initiation of 4-years independent programs in ARCH, URPL and LA, plus an additional program in Building Science and Technology (BSTC) following the first an interdisciplinary common year (College of Architecture and Planning, 2009). The department of LA received the first batch of applicants in 1993 who graduated in 1996 as landscape architects on this curriculum. Based on the preparatory year system approved by the UoD council in 2008 for the engineering track includes the Colleges of Architecture and Planning, Design and Engineering (Deanship of Preparatory Year and Supporting Studies, 2015), the second review was required to adapt the amendments resulted of such approval. The curriculum of landscape architecture did not affected by the application of the preparatory year as it continued receiving students after the first year. However, minor amendments were necessary to preserve the total number of hours required.

After receiving two batches passed through the preparatory year program, the college of Architecture and Planning noticed certain weakness in the required skills especially for the students who were transferred to departments that required competitive skills in psychomotor, critical thinking and presentation. Accordingly, the decision had been taken to adapt the first year

in the college to be an interdisciplinary common year for all students who passed the preparatory year program and eligible to join the college of Architecture and Planning. The curriculum of this interdisciplinary common year was designed with an aim to improve skills of drafting, reading and understanding architectural drawings; educating the students design process as well as basic knowledge regarding structure, construction materials and surveying. Accordingly, the departments informed to review and update their academic programs, considering the courses of the second common year; and accommodating their specialized courses into three academic years (six levels/semesters).

## **2.2 Review Process and BSLA Curriculum Design**

BSLA program has been reviewed and updated based on the second common year and three specialized program leading to the Bachelor Degree of Landscape architecture. The review process went through four stages: stakeholders' survey (including the groups of employer bodies, previous graduate, department staff and students), addressment of received comments, sending the revised draft to specialised international reviewers and organization of workshop(s) for focus group discussion.

a. Stage 1: Courses specification set up was immediately followed the approval of the second common year as a core year for all departments of the college. The LA department staff worked on reviewing and updating the courses specification. All courses of the program were redesigned and updated based on the National Commission for Academic accreditation and Assessment (NCAAA) requirements and specifications. The produced 216 pages document sent to major employer bodies, previously graduated students and presented to staff and existing students in two workshops. The second draft of the curriculum was produced, taking into consideration all comments and suggestions resulted from stakeholders' reviews and the two workshops.



b. Stage 2: Reviewing and addressing received comments from stakeholders and the outcomes of two workshops discussions.

c. Stage 3: Sending the second draft revised curriculum to external reviewers. Based on their experience in landscape education and academic practices. Four international reviewers have been selected from USA, UK and Germany to review and evaluated the developed BSLA curriculum. Their major comments were generalized in (table 1) below, and has been addressed in the final revised draft.

**Table 1: Comments of the External reviewers**

No	Comments/Notes on the curriculum content
1	Very much directed to professional education & prepare students to practice mainstream profession in a regional context
2	It is sufficient in relation to the total number of credit hours
3	Logical sequence of courses and can be clearly seen how various related courses are coordinated.
4	The relationship between design studios and lectures is well balanced and conducive
5	The structure and scope of the curriculum are sound and superior
6	Inclusion of practical training into the course structure is a very good thing, help the transition from academic to professional
7	Need courses on Law, Zoology, Bioengineering, Phytosociology, Soil, Hydrology & human factors
8	Course structure implies an old attitude of looking at graphic skills in terms of drafting and presentation. It should be an integral part of the design process
9	Suggestion to reduce credit hours per semester to 15; some courses could be combined or taught as part of the design studio
10	There is a significant range of alternatives offers to the students to develop a useful focus
11	Three emphasis of elective courses offers students the option to specialise across the spectrum of the professional opportunities (strategic & regional landscape planning, environmental conservation and management, heritage & tourism, bioengineering, garden design,)

d. Stage 4: focus group discussion: based on addressing all comments received from three of the external reviewers, another version of the curriculum draft has produced and presented to a selected group of stakeholders, previously graduated students and academic staff in a discussion

environment. Two workshops were independently organized to discuss the final version of the curriculum draft. The first was for stakeholders who raised several comments and issues list together with the department's staff opinions in (table 2) below.

**Table 2: Comments of the stakeholders and Graduate and the department Reactions**

No	Issues, Comments/Notes on program	LA Department Opinions
1	Reduce the number of Islamic Courses from four (4) to two (2) courses and utilize the (4) hours in other courses of major relation.	Islamic courses are University's requirements that cannot be altered and there is a committee deal with updating these courses to suit the current situation and the college recommend some topics related to professional ethics
2	Merging the two courses of History LARCH 341 & 342 and make more emphasis on research methods	History has major impacts in development of student attitude and analytical orientation which reflected on demonstrating and developing design philosophy. By making them two separate courses will emphasize theories and philosophies of design at different stages and relate these issues to the development of the local landscape
3	Some trainee students have lacked skills of site engineering and construction details, where emphasis on this are clear the new amendments of the program.	Positive comment. The department felt there is a need to put more emphasis on these issues. So they have been considered in the new amendment of the program.
4	Shuffling and replacement of the planting courses. Reschedule LARCH 312 planting design course to be taken before LARCH 311 Plant Identification and use	From the experience, student cannot design with plants before they learn basic information about them. So they have been taught the first course: LARCH 311 "Plant ID and Use" prior to planting design and before use them as design element.
5	Increase emphasis on construction materials and techniques including pavement and construction materials, as well as value engineering in landscape.	Department emphasizes these issues in each design studio and support them in number of theoretical/practical courses such as site engineering (2 courses), Construction materials (2 courses), Irrigation systems design (1 course)
6	Apply more emphasis to the large scale projects such as national parks, and regional natural parks	Positive, LARCH 402: Landscape planning Studio is dealing with such projects from the planning stage to the management plan. And in some cases, deals with the design.
7	Shifting the summer Training to the First or second semester in order to engage students into running projects, as summer slowdown most of the construction activities.	Decided at college level and by practice found that successfully training period should not exceed 400 training hours which can be achieved during summer break and that will help students to graduate within the period of the program.

The second workshop was held with two of the Dutch professors (one of them reviewed the second draft of the program earlier). In common meeting with the department staff, the revised curriculum

presented to the two guests and reviewed part by part with emphasis on the external reviewers' and stakeholders' comments and the response of the department to them. At the end the guest professors confirmed the sound professionalism of the program and its ability to graduate fully skilled landscape architects.

### **2.3 Features of the latest LA curriculum's review**

Based on the approval of the preparatory year, the department of LA embarked upon reviewing and updating the curriculum to keep up with latest development in the scientific fields as well as to meet the community needs (Department of Landscape Architecture, 2014). The review revealed a need for amendments to:

- a. Course contents: as some of the courses were updated based on the stakeholders and reviewers' comments, to address the recent development in the field of profession and to satisfy the community needs and stakeholders requirements.
- b. Some course titles were updated to reflect the new content.
- c. Relocate some courses due to college's approval of the two common years (preparatory and Interdisciplinary) and three years specialized departmental programs.

The amendments of the curriculum have restructured the pedagogical scaffolding to promote interactive learning, motivating students to recall fundamental accumulative knowledge and technical skills from different areas and fields to solve specific design problems (Rotar, et al, 2014; Rotar & Barbarash, 2015), with an aim of graduating skillful landscape designers and leaders in the professional related issues Table 3 compares the main elements of the two curriculum; the 1992 and the new one. Although the total credit hours in the major of LA as well as other majors of the college has become 104 reduced by 10 hours, the departments are benefiting from the common

courses (34 credit hours in total) offered to all students who joined the college in the interdisciplinary second year. In addition, more emphasis are applied to teaching and evaluation methods which consequently will improve the outcome products.

**Table 3: comparison of the main elements of the old and new LA curriculum**

Elements		1992 Curriculum	New Curriculum
Structure	Year 1	Common (27 CR HR)	Preparatory (32 CR HR)
	Year 2	Major (36 CR HR)	Interdisciplinary (34 CR HR)
	Year 3	Major (34 CR HR)	Major (34 CR HR)
	Year 4	Major (35 CR HR)	Major (37 CR HR)
	Year 5	Major (33 CR HR)	Major (33 CR HR)
Number of CR HRs		<b>165 Credit Hours</b>	<b>170 Credit Hours</b>
Pure LA	No. of Courses	30+4 electives major –oriented= 34	26+2 electives major –oriented + 2 electives from other areas = 30
	Total CR HRs	102 + (12 electives) = 114 CR HR	92 + (12 electives) = 104 CR HR
Building up knowledge		Scattered, unclear pathway	Correlated, sequential complexity, clear themes of design studios
Teaching methods		Knowledge transformation with little emphasis on how it applied	Experience (knowledge and skills) into design process
Learning objectives		Demonstrate graphic skills into presentations	Acquire basic knowledge, develop fundamental skills, and combine them in a critical thinking process.
Outcomes		Impressive graphic presentation with superficial content	Solutions based on systematic design process, skilled cooperative designer and leaders
Evaluation		Focuses on quality of products (graphic skills & presentation)	Focus on the process and reliability of data and their applications

The emphasis of each design studio has been clearly identified and built upon the acquired knowledge and skills gained from the previously taught courses in earlier levels as well as supporting courses in the same level of the design studio. The themes vary from site design

practiced in LARCH 301: Landscape Design Studio V through a medium to large scale urban landscape design as in LARCH 401: Landscape Design Studio VII, or landscape planning as in LARCH 402: Landscape Design Studio VIII to finally a comprehensive graduation project in LARCH 502: Landscape Design Studio X. Themes, nature, requirements and expected outcomes of each design studio.

### **3 APPROACH OF EDUCATING NEW CURRICULUM OF LA IN UOD**

Upon the approval of the new curriculum which is designed to emphasize the building up and accumulation of skills and knowledge in both vertical and horizontal levels, and the desire and ambition of the department to graduate fully skilled landscape architects; a new approach has been adopted to integrate teaching of theoretical courses and design studios courses. The approach focuses on the application of design process at all design studios' levels and themes regardless of the complexity of the project(s) with an emphasis on the students' personal experiences and both students and instructors' reflection on these experiences. At the same time, the acquired knowledge and skills from pre- and co-courses at the level of each design studio must be embodied and reflected on the design solutions or its requirements, such as construction and technical drawings. This education approach has proven influential effects in educating students of the built environment's disciplines. It stimulates converting implicit knowledge to explicit, and at the same time affects ability of transferring forms of knowledge in professional practice (Lawson, 2010; Bulkeley, 2006). This approach is thought to stimulate critical thinking and problem-solving process, which constitutes major elements of human intelligence. According to Gardener (1995) human intelligence, as pointed out by multiple intelligence theory, comprising language, mathematics and logic, music, limbs use, space, interpersonal, introspection and natural sciences

are similar to traditional ethics intelligence, physical, gregarious art. And it is difficult for a single discipline to achieve multiple intelligence education, as it consists of cognition, skills and affection goals (Liao, et al, 2015).

In the way of graduating fully skilled landscape architects eligible for postgraduate studies and/or professional practice, the education practices have placed an emphasis on critical thinking and evaluation as well as on competencies and skills. Empowering LA graduates with these skills and competencies enable them to join the professional fields easily as they acquired balanced dose of practical and theoretical knowledge and skills as well as the process of transferring them into beneficial outcomes. As reported by Poxon (2001) graduates' preparation placed emphasis on critical thinking and evaluation while practitioners' preparation required mastering competencies and skills needed for various workplaces.

The department's strategy for education of landscape architecture subjects and issues has developed based on the emphasis of three pillars:

1. Creation and enhancement of self-confidence through encouragement of students in different levels to speak about and present their ideas in a healthy discussion environment.
2. Development of Logic judgment built upon evaluation and criticism supported by scientific facts, evidences and proofs.
3. Encouragement of healthy debate and discussions using acquired knowledge to support and defend an argument. Thus in all theoretical and practical courses these issues have emphasized in the form of group discussion, presentations and seminars.

Continuous practice of and training on these skills and competences help developing the common elements of critical thinking such as: analysis of arguments (Halpern, 1998 and Paul, 1992); inferences development using inductive and deductive reasoning (Willingham, 2007 and Paul, 1992); ability of judgement and evaluation (Case, 2005 and Tindal & Nolet, 1995); and making decisions or solving problems (Willingham, 2007 and Halpern, 1998).

### **3.1 Cooperative Learning and Experiment of Participatory Vertical Studio (PVS)**

According to the cooperative learning theory, the best learning occurs when students are actively engaged in the learning process and working in collaboration with other students to accomplish a shared goal. Cooperative learning is related to what so-called "21st century skills", including critical thinking, metacognition and motivation (Lai, 2011). However, the importance of students' relationships with others in developing critical thinking skills is argued that cooperative learning structures are triggers of critical thinking skills and likewise (Lai, 2011; Thayer-Bacon, 2000 and Bailin et al, 1999).

In the LA department of UoD, the staff are working hard to develop such a strong relationship between students which thought to be major factor in the success of working in groups and cooperative learning. During the first semester 2015/2016 the department has decided to allocate the last four weeks of the semester for interactive cooperative learning exercise. Students of the three different levels (fifth, seventh and ninth) have been mixed to work together in construction phase, using the design of the 12 action areas developed by the students of the seventh level design studio. The 48 students have been divided into 12 groups, each of four members representing all three levels with aim of educating each others and assembly their construction element at the end, which developed based on the construction drawings of each action area.

Each of the 12 groups have worked on one of the action areas developed by seventh level's students in what has been named PVS "participatory vertical studio". Based on the aim of this studio, further development of the design solutions and construction drawings with emphasis on detailed construction drawings for one landscape element have been practiced for 2.5 weeks in an interactive and healthy discussion environment within each group and with the other groups. At

the end, due to time limitation, one structural element had constructed by students from the three different levels (figures 1, 2, and 3).



**Figure 1: Sketch for the intended construction element, and the final product behind the student group, university director, chairman and some of the LA staff.**



**Figure 2: Preparation for construction, students received visits of chairman and vice deans.**



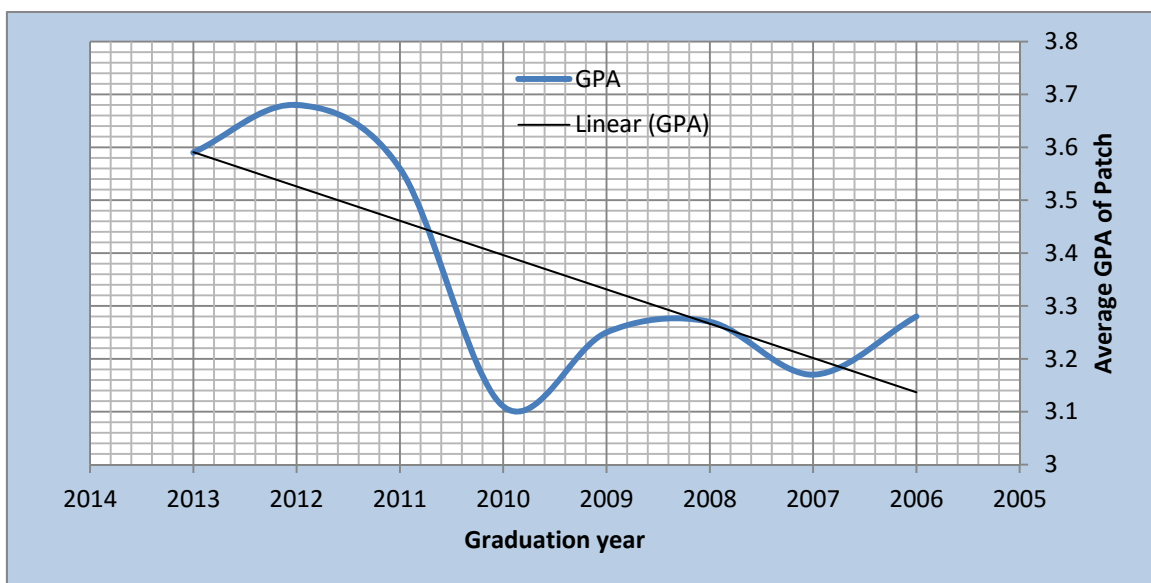
**Figure 3: Trying innovative solution for foundation and vertical support.**



During the construction phase, innovative solutions have been developed by students to overcome the difficulties and restrictions of the selected site. These include no constructed foundation on the lawn, exposure to strong wind and sometimes showers of rain. The students have developed a solution of flexible foot-base, constructed as linear box of 20 cm deep where vertical wooden structures fixed firmly to it and filled with cast-in-situ concrete. And to ensure the stability of the structure, each vertical element was anchored to the ground.

#### 4. RESULTS AND DISCUSSION

On one hand, the pedagogical design of the LA curriculum has proved its success. The statistics of students joined the department in 2008 following the approval of preparatory year and the second common year, graduated in 2011 have showed considerable improvement in the average accumulated GPA of the graduated patches in 2011, 2012 and 2013 in comparison with the previous patches (figure 4).



**Figure 4: considerable improvement in the average GPA followed the application of the new curriculum in 2008.**

This improvement in the average accumulated GPA of the graduated patches was a reflection of acquired knowledge and skills and their application in both theatrical and practical design courses. However, the teaching methods and adopted ways for exchange of experience and knowledge help the development of graduates' personality. They have become able to work in groups, lead the group, and taking decisions. They are able to follow design process and critical thinking methods to integrate theoretical scientific knowledge and practical data collected on site characteristics to solve design problem(s). The quality of LA graduates has attracted private firms and semi-governmental institutions to seek employment of them. The Royal Commission of Jubail has attracted more than ten landscape architects of the UoD graduates, working in design, management and supervision of several projects in the departments of landscaping, gardening and urban design.

One the other hand, grouping students to work hand on hand to construct a landscape element have revealed great deal of advantages. Students from different levels collaboratively worked together to construct the structure; and when the face any difficulties they set together thinking of solutions and discussing their ideas before present them to the instructors. The patient and enthusiasm showed by students encouraged the stuff to work with them trying to help and develop the students' ideas. Working in such healthy cooperative environment has developed strong intimate relationship between the students and between them and their instructors and the university' community, which make the students proud of what they did. The knowledge and skills exchange practiced, and the processes the students went through have great value to their learning experience they will never forget.

## REFERENCES

- Bailin, S., Case, R., Coombs, J., & Daniels, L. (1999). Conceptualizing critical thinking. *Journal of Curriculum Studies*; Vol. 31, No. 3, 285-302.
- Bulkeley, H. (2006). Urban Sustainability: Learning from the Best Practice? *Environment and Planning*; vol. 38, 1029-1044.
- Case, R. (2005). Moving critical thinking to main stage. *Education Canada*; Vol.45, No. 2, 45-49.
- College of Architecture and Planning. (2009). Academic Manual (in Arabic). Dammam, Kingdom of Saudi Arabia: University of Dammam.
- Department of Landscape Architecture. (2014). *The Bachelor degree program of Landscape architecture* (draft). Dammam.
- Gardener, H. (1995). Reflections on multiple intelligence. *Phi Delta Kappan*; Vol. 77, No. 3, 200-208.
- Halpern, D. (1998). Teaching critical thinking for transfer across domains: dispositions, skills, structure training and metacognitive monitoring. *American Psychologist*; Vol. 53, No. 4, 449-455.
- Lawson, G. (2010). Changing pedagogic codes in a class of landscape architects learning "ecological sustainable development". *British journal of Sociology of education*; Vol. 31, No. 2, 199-216.
- Lai, E. (2011). *Collaborative: a literature review*. Pearson <http://images.pearsonassessments.com/images/tmrs/Collaboration-Review.pdf>, accessed on 19 December 2015.
- Liao, C., Chiang, Y., Chang, Y., & Liao, T. (2015). Develop scientific inquiry integrating into project practice teaching of innovative curriculum for vocational high school. *International Journal of Information and Education Technology*; Vol. 5, No. 5, 391-396.
- Paul, R. (1992). critical thinking: what, why and how? *New Directions for Community Colleges*; Vol. 77, 3-24.
- Preparatory year and supporting Studies. (2015). *About the Deanship*. the University of Dammam: <http://www.uod.edu.sa/ar/administration/deanships/deanship-of-preparatory-and-supporting-studies/about>, accessed on 29 October 2015.
- Poxon, J. (2001). Shaping the planning profession of the future: The role of planning education. *Environment and Planning B: Planning and Design*; Vol.28, 563-580.
- Rotar, S., & Barbarash, D. (2015). Integrated Project Experiences and Student Perception. *CELA 2015: Incite Change - Change in Sight, 24-28 March 2014* (pp. 192-198). Kansas: Kansas State University.
- Rotar, S., Barbarrsh, D., Dahl, B., & Hildner, A. (2014). Improving Student Learning through

- Integrated Project experiences. *Landscape Research Record*, Vol. 1, 63-71.
- Thayer-Bacon, B. (2000). *Transforming critical thinking: thinking constructively*. New York: Teachers College Press.
- Tindal, G., & Nolet, V. (1995). Curriculum-based measurement in middle and high schools: critical thinking skills in content areas. *Focus on Exceptional Children*; Vol.27, No. 7, 1-22.
- Willingham, D. (2007). Critical thinking: why is it hard to teach? *American Educator*; Vol.31, No. 2, 8-19.

## **BIO**

### **Dr. Ali Omar M. Al-Sulbi, Assistant Professor, University of Dammam, Kingdom of Saudi Arabia**

Dr. Al-Sulbi holds PhD on environmental resources planning and management from the University of Manchester, UK. He is interested in landscape and urban design, green infrastructure, landscape and environmental planning and management. Dr. Al-Sulbi published papers and articles related to these issues and participate in projects of urban design landscape and irrigation systems as designer as well as an academic professor of landscape architecture.



COUNCIL OF EDUCATORS  
IN LANDSCAPE ARCHITECTURE

*A CELA Conference Presentation*

**Abstract ID: 432**

## **CREATING MULTIDISCIPLINARY TEAMS TO ENHANCE LANDSCAPE ARCHITECTURE EDUCATION**

### **DALTON, ROBERT**

PhD candidate, School of Planning, Design and Construction, Michigan State University

### **CRAWFORD, PAT**

Associate Professor and Associate Director, School of Planning, Design and Construction, Michigan State University

### **DEJONG, CHRISTINA**

Associate Professor, School of Criminal Justice, Michigan State University

### **ABSTRACT**

*With each discipline comes an epistemology and practice (Bauer, 1990), uniting to form the organization's unique culture (Jurin, et al., 2010). The built environment disciplines could be placed into two families: the architects and the engineers (Olsen and MacNamara, 2014; Pfammatter, 2000). Evolving technologies such as BIM (Olsen and MacNamara, 2014) or practices and processes such as Lean Construction (Forbes and Ahmed, 2010) demonstrate the growing need for professional collaboration in problem solving. Intradisciplinary students will likely function in a dualist mentality (Perry, 1981), but multi or interdisciplinary collaboration may aid student transitions into a relativist or a commitment epistemology.*

*The research team designed and conducted twenty-five interviews around the world and among the built environment disciplines to gather information for a professional culture survey. A factor analysis of the survey responses showed the professions usually work in three families: (1) exterior spaces, (2) building and interior spaces and (3) legal and real estate. Landscape architects quantitatively cluster into the first factor with urban planners, ecologists, civil engineers and others.*

*A visual depiction of these relationships shows that landscape architects practice in a fairly balanced manner among the three factors. Utilizing Perry's Scheme as framework, this study proposes the key majors with whom Landscape Architecture students should partner depending upon one's evolving epistemology. Those practicing for the first time in a multidisciplinary team may not have achieved the cognitive levels to process information and act accordingly in the interdisciplinary or transdisciplinary realms (Perry, 1970). Such integration is most successful with cultural collaboration and idea exchange with professionals, administration, faculty, and students (Glasser, 2000).*

### **1.1 Keywords**

Multidisciplinary Training, Built Environment Teams

---

The authors are solely responsible for the content of this technical presentation. The technical presentation does not necessarily reflect the official position of the Council of Educators in Landscape Architecture (CELA), and its printing and distribution does not constitute an endorsement of views which may be expressed. Technical presentations are not subject to the formal peer review process by CELA Track Chair System; therefore, they are not to be presented as peer-reviewed publications. Citation of this work should state that it is from a CELA conference paper. EXAMPLE: Author's Last Name, Initials. 2014. Title of Presentation. CELA Paper No. 14-xxxx. Baltimore, Maryland: CELA. For information about securing permission to reprint or reproduce a technical presentation, please contact CELA at [dsolco@uta.edu](mailto:dsolco@uta.edu) or 817-272-2321.

## 2 INTRODUCTION

Working in the built environment professions (from planning, to design to construction) is an increasing complex proposition. Issues from climate change to urbanization are requiring the professions to work more collaboratively across the full life span of a project, from idea conception to the built work, to deliver projects on-time and within budget (Webb, 2010; Wood, 1999). Inter-disciplinary firms offering connected services across the planning, design and construction disciplines are attractive to potential clients as one way of controlling project costs (Coleman, 2002). With these realities in mind, Landscape Architecture education faculty can capitalize on the situation by providing students with the skills they will need to navigate an ever increasing complex and collaborative work environment. To begin exploring educational responses in our classes and curricula, a couple of foundational questions must be explored. The first is around concepts of student cognitive development and educational design. The second is with which professions Landscape Architects most closely work in practice.

The Perry Scheme of Intellectual Development is one tool understand and access student development and learning readiness (Perry, 1981). In the Perry scheme, learning begins in *dualism* in which the learner can recognize right from wrong or authority of knowledge and student. In *multiplicity*, a learner is able to respect the knowledge contributions of others but fail to discern who may have the most accurate or well-formed view. *Relativism* is the stage in which the learner recognizes who is *most right* in a given situation. Lastly, the learners enter the stage *commitment in relativism* in which they will balance multiple aspects of themselves, their learning, new perspectives, and apply this to problem solving both inside and outside of the classroom (Perry, 1981).

Within educational design, integrative learning experiences help students develop the connections among courses, co-curricular activities, and professional and personal experiences

(Klein, 2005). Interdisciplinary experiences, Klein writes, are part of integrative learning. An interdisciplinary approach is one that demands multiple disciplines to come together to solve (Stember, 1991). Much like the reality being faced by built environment firms in the field, needing to work in collaborative and multi-disciplinary teams to address current issues in fiscally responsible ways. While students in the earlier stages of Perry's Scheme may not yet be ready for a truly interdisciplinary experience, educators need to acknowledge at which stage their students are starting and find ways to foster their development for success in practice. This study brings together two foundational pieces of information: first, knowledge of students' cognitive development stages, and second, which majors could be the most beneficial for LA students to begin learning how to work with in collaborative team settings.

### **3 LITERATURE REVIEW**

Steve Jobs and Bill Gates started to revolutionize the world to their view in the 1970s, but each from different perspectives. Jobs was given up for adoption and his parents needed to stretch finances to provide for him. Gates was born to a wealthy, Seattle family and attended private schools (Shah and Mullah, 2013). Isaacson (2011) describes these men as in need of each other's perspectives and skills to create a well-rounded product. Jobs was the designer and the visionary, he wrote, while Gates is the pragmatist and is technologically savvy. Jobs sought to influence people and behavior, while Gates seeks to develop technology (Shah and Mullah, 2013). Today, Apple stores and technology are still known for their simplistic and sleek aesthetics. Both perspectives are important, but it is difficult for even the most creative geniuses to thrive in this duality. Instead, one may seek partnerships to integrate differing views and skill sets.

Having the skills to work in an integrative manner, across disciplinary boundaries, is a skill that can be fostered and enhanced in educational settings. The AAC&U VALUES Rubric (2009, no page) defines *integrative learning* as:

“an understanding and a disposition that a student builds across the curriculum and co-curriculum, from making simple connections among ideas and experiences to synthesizing and transferring learning to new, complex situations within and beyond the campus.”

This is similar to Ravitch’s (2007) definition, but she goes further to include multiple pedagogies and delivery methods as part of this learning process. Integrative learning pedagogies in the classroom may aid students to build interpersonal and professional relationships to solve complex problems; a necessary employment skill (Bureau of Labor Statistics; Dalton, 2013; Wilson and Zameberlin, 2012).

Multiple built environment disciplines are encouraging collaboration across the design and construction professions. Construction management utilizes integrated project delivery (IPD) to bring together multiple offices and disciplines for a single development. This differs from integrative learning as it is the *application* of learned integrative and collaborative skills to solve the problems traditional project delivery may cause. Traditional project delivery allows for different types of contracts, as Forbes and Ahmed (2011) explored. Clients use Design-Bid-Build, hiring an architect/engineer to design the structure and construction documents. Contractors and developers bid for the best price to build the project and the winners sign binding contracts. This process suffers from delays in communication among the parties, puts contractor at risk, and thus increases client costs (Berghorn, 2014). The client benefits, though, as the design team focuses on the client’s needs. Design-build is the fastest delivery system as all



documentation is kept ‘in house,’ but limits owner involvement. The Engineer-Procure-Construct keeps all documents in house, but negates the architect’s creativity in planning and design.

Partnering touches upon the ideas of IPD by encouraging (1) early participation of all bodies within the construction project, (2) open communication and trust, and (3) focuses on the greater whole rather than the pieces.

Urban planning is seeking to integrate planning policy knowledge at both the macro and micro scales in higher education (Hjorth and Wilensky, 2014). An urban planner must have the long term vision and grandiose vision of Robert Moses, but also the human scale knowledge of how policies affect behaviors and day to day lives (Burden, in Urbanized, 2011). This becomes an increasing complicated task as urban planning students find entry level work around the world and must participate with local citizens to formulate innovative and equitable policies. These policies include plans for transportation, schools, human health, and air and water quality (Cohen and Schuchter, 2013). As these students and recent graduates shift locations, it is important for them to be representative of and work with a diverse citizenry (Sweet and Etienne, 2011).

Integrating both within oneself and among teammates is not an easy process. Each newly formed (successful) team progresses through five stages: forming, storming, norming, performing, and adjourning (Tuckman and Jensen, 1977). It is the *storming* stage that can make or break a team. This is the time for all ideas to come to the table and debate new perspectives. If no one properly leads this stage, the team can lose energy, participation, and possibly fail in its task. These new perspectives are brought together when two professional cultures interact (Jurin, et al., 2010; Bauer, 1990), but may be aided with open communication (Jurin, et al., 2010). Higher education will have limited time to achieve integrative learning (inclusive of interdisciplinary experiences) and to help a student understanding Tuckman and Jensen’s stages.

An educator may use this time to help a student to practice collaboration with whom they will likely practice with in professional offices.

#### **4 METHODS**

Jurin, et al. (2010) define a culture as a group with shared knowledge, values, practices, and language or communication. Using these four aspects of a culture, the research team analyzed over 200 publications to define cultural integration, cultural characteristics and those characteristics specific to the built environment professions. With the cultural framework, the research team designed a 30-minute to one-hour qualitative interview. One of the questions in the interview asked the participants to list the other professions with whom they frequently work. The interviews included 25 practitioners representing landscape architecture, urban planning, construction management, interior design, and architecture. Both the public and private sectors participated. The surveys were in person and via phone to include practitioners in San Francisco, Chicago, Ann Arbor, Michigan, East Lansing and Lansing, Michigan, Fort Lauderdale, New York City, and London.

Another qualitative cluster analysis groups the key words and phrases from the interviews into a Qualtrics survey. The survey asked respondents to choose how often they work with specific built environment professions. The list of professions was generated from the interviews, but limited in scope to ease the attrition rate. Respondents could choose along a 5 point ordinal scale: (1) never, (2) a few times a year, (3) monthly, (4) weekly, and (5) daily. Professional organizations and alumni networks helped to distribute the survey through posting on social media, their websites, and sending to their email lists. Thus, calculating the response rate is not possible.

Using SPSS 21, the research team began with 6 professional stakeholder groups as the independent variable: landscape architects (LA), construction managers (CM), interior designers (ID), urban planners (UP), related built environment professions (real estate, architecture, engineering), and other (social services, education; those influence by built environment policies). The dependent variable was the response to how often the respondent work with the professions listed in the survey (Table 1). Using an ordinal regression was not possible as the responses violated the test of parallel lines. The research team decided the sample size/responses were inadequate for multinomial logistic.

The team completed a principal component analysis (PCA) of all respondents' to the dependent variable. The PCA yielded three factors of professions. A positive loading value of .5 or above was considered significant. The highest, valid loading value determined the family for each dependent variable. Using SPSS, the team created a continuous mean variable of the professions within each factor. An additional continuous, mean variable was computed for overall frequency of working with other professions. ANOVA tests performed with Fisher's Least Significant Difference (LSD) post-hoc tested for significance among the five analyzed stakeholders (LA, CM, ID, UP, Related) and between each stakeholder.

## **5 RESULTS**

### **5.1. Mean Results**

With a mean rating of 4.27, 3.71, and 3.55 respectively, landscape architects indicate they work more frequently with other landscape architects, civil or structural engineers, and architects. Mean rating of 1.51, 1.90, and 1.95, landscape architects work most infrequently with economists, interior designers, and lawyers (Table 1). Overall, the five stakeholder groups report most frequently collaborating with construction managers (3.69), architects (3.58), and civil or

structural engineers (3.44). Of the non-LA stakeholders, urban planners report working with landscape architects most often (2.82).

Table 1: Key stakeholder groups' mean rating, sample size and standard deviation for frequency working with other listed professions

	<b>Construction Management</b>			<b>Interior Design</b>			<b>Landscape Architecture</b>		
	Mean	N	Std. Dev.	Mean	N	Std. Dev.	Mean	N	Std. Dev.
<i>Architects</i>	3.81	183	1.226	3.96	99	1.160	3.55	159	1.210
<i>Civil or Structural Engineers</i>	3.68	182	1.018	2.69	99	1.234	3.71	159	1.182
<i>Construction Managers</i>	4.63	180	0.762	3.74	100	1.088	3.19	159	1.148
<i>Ecologists (soils, wetlands, horticulture)</i>	2.03	182	0.831	1.33	100	0.604	2.59	159	1.063
<i>Economists</i>	1.41	181	0.766	1.15	100	0.479	1.51	159	0.786
<i>Electrical or Mechanical Engineers</i>	3.40	183	1.084	3.12	100	1.241	2.42	159	1.076
<i>Interior Designers</i>	2.58	183	1.232	4.65	100	0.903	1.90	157	1.063
<i>Landscape Architects</i>	2.32	182	0.991	2.27	99	1.048	4.27	156	1.236
<i>Lawyers</i>	2.11	182	0.898	1.48	100	0.659	1.95	158	.943
<i>Lighting Specialists</i>	2.04	181	0.942	2.49	100	0.990	2.19	158	.911
<i>Municipal Boards or Elected Officials</i>	2.22	183	0.924	1.85	100	0.978	2.94	157	1.142
<i>Real Estate Brokers or Developers</i>	2.24	183	1.217	2.63	99	1.274	2.31	158	1.172
<i>Site Surveyors</i>	2.60	183	1.000	1.82	100	1.038	2.72	158	1.034
<i>Transportation Engineers or Planners</i>	1.91	182	0.993	1.27	99	0.531	2.41	158	1.118
<i>Urban Planners</i>	1.59	182	0.854	1.58	100	0.912	2.60	159	1.302
	<b>Urban Planning</b>			<b>Related Professions</b>			<b>Total</b>		
	Mean	N	Std. Dev.	Mean	N	Std. Dev.	Mean	N	Std. Dev.
<i>Architects</i>	2.79	75	1.131	3.41	97	1.491	3.58	613	1.291
<i>Civil or Structural Engineers</i>	3.35	75	1.033	3.36	97	1.393	3.44	612	1.215
<i>Construction Managers</i>	2.61	74	1.301	3.55	99	1.365	3.69	612	1.294
<i>Ecologists (soils, wetlands, horticulture)</i>	2.82	74	0.912	2.10	99	1.083	2.17	614	1.030

<i>Economists</i>	2.16	75	0.839	1.65	99	0.929	1.52	614	0.819
<i>Electrical or Mechanical Engineers</i>	1.92	75	1.075	2.89	99	1.377	2.84	616	1.260
<i>Interior Designers</i>	1.72	74	1.129	2.40	98	1.282	2.61	612	1.484
<i>Landscape Architects</i>	2.82	76	1.151	2.34	99	1.214	2.88	612	1.395
<i>Lawyers</i>	2.81	75	0.926	2.01	99	0.942	2.04	614	0.953
<i>Lighting Specialists</i>	1.36	75	0.607	1.89	99	0.999	2.05	613	0.967
<i>Municipal Boards or Elected Officials</i>	4.05	75	0.943	2.31	99	1.066	2.58	614	1.210
<i>Real Estate Brokers or Developers</i>	3.41	74	1.313	2.25	99	1.280	2.46	613	1.289
<i>Site Surveyors</i>	2.55	75	1.119	2.42	99	1.089	2.47	615	1.084
<i>Transportation Engineers or Planners</i>	3.47	75	1.155	2.01	99	1.233	2.14	613	1.198
<i>Urban Planners</i>	4.57	76	0.838	1.94	99	1.086	2.27	616	1.404

## 5.2. Principal Component Analysis

Using all 800 respondents, inclusive of those who work is strongly influenced by built environment structures and polices (social services, education) (Cohen and Schuchter, 2013), helps to define like families. Positive loading values indicate requited relationships of frequency of working together (Table 2). If one variable increases, so does the other.

The first component explains the majority of the variance (Table 3) and is comprised of those who work primarily in *exterior spaces or large scale*: civil or structural engineers, ecologists, landscape architects, site surveyors, transportation engineers or planners, urban planners, and municipal boards or elected officials. The second component includes those who work primarily in *interior spaces*: architects, electrical or mechanical engineers, interior designers, construction managers, and lighting specialists. The third component represents those in *legal and real estate*: lawyers and real estate brokers or developers. Economists do not significantly test into any of the three components.

Table 2 Principal Component Analysis Results

	Component		
	1	2	3
<i>Architects</i>	0.545	0.633	-0.025
<i>Civil or Structural Engineers</i>	0.760	0.233	-0.321
<i>Ecologists (soils, wetlands, horticulture)</i>	0.667	-0.285	-0.314
<i>Economists</i>	0.410	-0.296	0.283
<i>Electrical or Mechanical Engineers</i>	0.445	0.698	0.031
<i>Interior Designers</i>	0.173	0.700	0.362
<i>Construction Managers</i>	0.386	0.622	0.037
<i>Landscape Architects</i>	0.644	0.039	-0.363
<i>Lighting Specialists</i>	0.433	0.537	0.107
<i>Lawyers</i>	0.430	-0.373	0.520
<i>Real Estate Brokers or Developers</i>	0.548	-0.101	0.579
<i>Site Surveyors</i>	0.682	-0.001	-0.139
<i>Transportation Engineers or Planners</i>	0.679	-0.429	-0.155
<i>Urban Planners</i>	0.637	-0.518	-0.012
<i>Municipal Boards or Elected Officials</i>	0.669	-0.452	.171

Table 3: Principal Component Analysis Variance Explanation

Component	Initial Eigenvalues		Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings
			Loadings			
	% of Total	Cumulative %	% of Total	Variance	Cumulative %	Total

1	4.732	31.550	31.550	4.732	31.550	31.550	3.944
2	3.084	20.557	52.107	3.084	20.557	52.107	3.414
3	1.237	8.244	60.351	1.237	8.244	60.351	2.960
4	.983	6.551	66.902				
5	.901	6.008	72.909				
6	.633	4.222	77.131				
7	.600	3.999	81.130				
8	.521	3.472	84.602				
9	.431	2.876	87.478				
10	.395	2.632	90.109				
11	.362	2.411	92.521				
12	.336	2.242	94.763				
13	.295	1.965	96.728				
14	.264	1.757	98.485				
15	.227	1.515	100.000				

### 5.3 ANOVA and Post-Hoc

Overall, landscape architects are the second most frequently working with other professions. Each stakeholder reports the highest mean of the collapsed variables within the component they fit during the PCA.

Table 4: Mean Frequency for Working with the Collapsed Variables (ordinal rating 1-5: never to daily)

Stakeholder		Overall Frequency Rating	Exterior Spaces	Interior Spaces	Legal and Real Estate
Landscape Architecture	Mean	2.6827	3.0323	2.6531	2.1321
	N	159	159	159	159
	Std. Dev.	0.62171	0.75423	0.80386	0.86868
Construction Management	Mean	2.5704	2.3346	3.2926	2.1721
	N	183	183	183	183

	Std. Dev.	0.55695	0.63466	0.77659	0.89205
Interior Design	Mean	2.3997	1.8288	3.5865	2.045
	N	100	100	100	100
	Std. Dev.	0.56404	0.6587	0.71027	0.83513
Urban Planning	Mean	2.8226	3.3647	2.0796	3.1133
	N	76	76	76	75
	Std. Dev.	0.67065	0.67265	0.87564	0.89885
Related Professions	Mean	2.4329	2.3506	2.8273	2.1313
	N	99	99	99	99
	Std. Dev.	0.66657	0.83574	0.96435	0.98609

### 5.3.1 Overall Frequency

ANOVA results report the model significant for comparing the stakeholders and their overall mean frequency (Table 5). Landscape architects' mean frequency is significantly higher than interior designers and the related professions (Table 6). Urban planners also work with others significantly more frequently than construction managers and interior designers. Construction managers work more frequently with others than interior designers.

Table 5: Model Significance for Overall Frequency

	Mean Square	F	Sig.
Between Groups	2.890	7.815	.000
Within Groups	.370		

Table 6: LSD Comparisons for Overall Frequency

(A) Stakeholder	(B) Stakeholder Comparison	Mean Difference (A-B)	Std. Error	Sig.
Landscape Architecture	CM	0.11233	0.06593	0.089
	ID	0.28301*	0.07761	0.000
	UP	-0.13983	0.0848	0.100
	Related	0.24987*	0.07785	0.001
Construction Management	ID	0.17068*	0.07562	0.024
	LA	-0.11233	0.06593	0.089



Interior Design	UP	-0.25217*	0.08298	0.002
	Related	0.13754	0.07587	0.070
	CM	-0.17068*	0.07562	0.024
	LA	-0.28301*	0.07761	0.000
	UP	-0.42284*	0.09254	0.000
	Related	-0.03314	0.08621	0.701
Urban Planning	CM	0.25217*	0.08298	0.002
	ID	0.42284*	0.09254	0.000
	LA	0.13983	0.0848	0.100
	Related	0.38970*	0.09274	0.000
Related Professions	LA	-0.24987*	0.07785	0.001
	CM	-0.13754	0.07587	0.070
	ID	0.03314	0.08621	0.701
	UP	-0.38970*	0.09274	0.000

### 5.3.2 Exterior Spaces Frequency

ANOVA results report the model significant for comparing the stakeholders and their *exterior spaces* mean frequency Table 7). Landscape architects work with the exterior spaces professions significantly more than construction managers and interior designers (Table 8). Urban planners, however, work with this group significantly more often than the other stakeholders. All stakeholders work with the exterior spaces professions significantly more than interior designers.

Table 7: Model Significance for Exterior Space Frequency

	Mean Square	F	Sig.
Between Groups	37.944	75.267	0.000
Within Groups	0.504		

Table 8: LSD Comparisons for Exterior Space Frequency

(A) Stakeholder	(B) Stakeholder Comparison	Mean Difference (A-B)	Std. Error	Sig.
Landscape Architecture	CM	0.69773*	0.07698	0.000
	ID	1.20351*	0.09062	0.000
	UP	-0.33235*	0.09901	0.001

	Related	0.68167*	0.0909	0.000
	ID	0.50577*	0.0883	0.000
Construction Management	LA	-0.69773*	0.07698	0.000
	UP	-1.03008*	0.09689	0.000
	Related	-0.01607	0.08858	0.856
	CM	-0.50577*	0.0883	0.000
Interior Design	LA	-1.20351*	0.09062	0.000
	UP	-1.53585*	0.10805	0.000
	Related	-0.52184*	0.10067	0.000
	LA	0.33235*	0.09901	0.001
Urban Planning	ID	1.53585*	0.10805	0.000
	LA	0.33235*	0.09901	0.001
	Related	1.01401*	0.10828	0.000
	LA	-0.68167*	0.0909	0.000
Related Professions	CM	0.01607	0.08858	0.856
	ID	0.52184*	0.10067	0.000
	UP	-1.01401*	0.10828	0.000

### 5.3.3 Interior Spaces Frequency

ANOVA results report the model significant for comparing the stakeholders and their *interior spaces* frequency (Table 9). Landscape architects work with the *interior spaces* professions significantly less than construction managers and interior designers, though significantly more than urban planners (Table 10). Unlike the *overall frequency and exterior spaces* frequency, interior designers work with the *interior spaces* professions significantly more than all other stakeholders.

Table 9: Model Significance for Interior Space Frequency

	Mean Square	F	Sig.
Between Groups	33.768	50.351	0.000
Within Groups	0.671		

Table 10: LSD Comparison for Interior Space Frequency

(A) Professions Merged	(B) Professions Merged	Mean Difference (A-B)	Std. Error	Sig.
------------------------------	------------------------------	-----------------------------	---------------	------

Landscape Architecture	CM	-0.63948*	0.08879	0.000
	ID	-0.93336*	0.10452	0.000
	UP	0.57354*	0.1142	0.000
	Related	-0.17413	0.10484	0.097
Construction Management	ID	-0.29388*	0.10184	0.004
	LA	0.63948*	0.08879	0.000
	UP	1.21302*	0.11176	0.000
	Related	0.46535*	0.10217	0.000
Interior Design	CM	0.29388*	0.10184	0.004
	LA	0.93336*	0.10452	0.000
	UP	1.50689*	0.12462	0.000
	Related	0.75923*	0.11611	0.000
Urban Planning	LA	-0.57354*	0.1142	0.000
	CM	-1.21302*	0.11176	0.000
	ID	-1.50689*	0.12462	0.000
	Related	-0.74767*	0.1249	0.000
Related Professions	LA	0.17413	0.10484	0.097
	CM	-0.46535*	0.10217	0.000
	ID	-0.75923*	0.11611	0.000
	UP	0.74767*	0.1249	0.000

#### 5.3.4 Legal and Real Estate Frequency

ANOVA results report the model significant for comparing the stakeholders and their *legal and real estate* frequency. This significance is created largely because the urban planners are significantly more likely than all other stakeholders.

Table 11: Model Significance for Legal and Real Estate Frequency

	Mean Square	F	Sig.
Between Groups	16.205	20.281	.000
Within Groups	.799		

Table 11: LSD Comparison for Legal and Real Estate Frequency

(A) Professions Merged	(B) Professions Merged	Mean Difference (A-B)	Std. Error	Sig.
------------------------------	------------------------------	-----------------------------	---------------	------

Landscape Architecture	CM	-0.04006	0.09691	0.680
	ID	0.08708	0.11408	0.446
	UP	-.98126*	0.12521	0.000
	Related	0.00076	0.11444	0.995
Construction Management	ID	0.12713	0.11116	0.253
	LA	0.04006	0.09691	0.680
	UP	-.94120*	0.12255	0.000
	Related	0.04082	0.11152	0.714
Interior Design	CM	-0.12713	0.11116	0.253
	LA	-0.08708	0.11408	0.446
	UP	-1.06833*	0.13654	0.000
	Related	-0.08631	0.12673	0.496
Urban Planning	LA	.98126*	0.12521	0.000
	CM	.94120*	0.12255	0.000
	ID	1.06833*	0.13654	0.000
	Related	.98202*	0.13683	0.000
Related Professions	LA	-0.00076	0.11444	0.995
	CM	-0.04082	0.11152	0.714
	ID	0.08631	0.12673	0.496
	UP	-.98202*	0.13683	0.000

## 6 Discussion

Overall, urban planners are the stakeholder most frequently working with other professions. This could be explained by the oversight and regulation roles of urban planners, especially in the public sector. Among all stakeholders, the construction managers, architects, and civil/structural engineers are the mostly frequent collaborators. This could be explained by a high proportion of construction managers and landscape architects in the sample, who both report frequently working with these groups. Though landscape architect respondents rate their frequency working with these groups fairly often, the PCA demonstrates that those who work with civil/structural engineers are more likely to be exterior professions. Civil and structural engineers are different professions and may independently fit better into different components, but the survey grouped them together to ease attrition rates.

Many college freshmen enter the university at the intellectual development stage of *dualism modified* (Perry, 1981). Built environment students often fit this trend as well (Lang, et al., 2011). This stage in Perry's scheme includes four positions, each a step towards understanding complexity. These students accept that "true authorities must be right, the others are

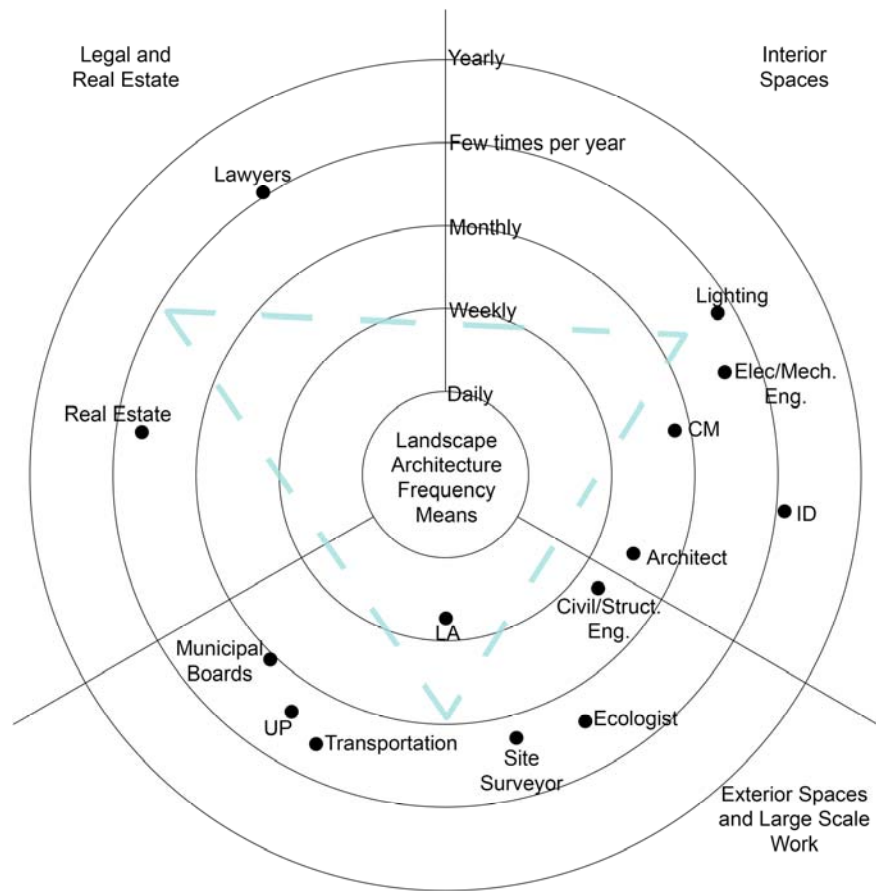


Figure 1 Mean frequency for working with other professions by PCA family

frauds" (Perry, 1981, 79). Such students should likely stay within the center circle of Figure 1: studying under landscape architecture faculty. Figure 1 demonstrates concentric rings (to scale), with those professions closer to the center more frequently working with landscape architecture practitioners (reversing the 1-5, aforementioned ordinal scale for visual purposes). The dashed triangle's vertices represent the mean rating of each of the three components. Compared to the other stakeholders, landscape architects practice fairly balanced among the three families. Perry's modification to his previous work shows the importance of transitional phases. A student within dualism must still transition to relativism. As such, the high frequency working with other

landscape architects helps educators to understand the importance of first partnering with LA students to transition towards *relativism discovered*.

During *relativism*, students accept complexity and begin to think outside the box. However, those in the earlier positions or relativism are unable to discern which answer is most correct or foresee long term ramifications. Although landscape architecture students share knowledge with architects and interior designers, the PCA demonstrates required relationships with the *exterior spaces* professions. Relativism students should begin partnership with these majors as they may challenge assumptions of truth, but within a realistic parameter. Pushing a student too quickly to challenge assumptions and beliefs may force a student to “retreat” or “escape” (Perry, 1981, 80), and thus fail to successfully transition through relativism.

For students transitioning to or within *commitment in relativism developed* can begin working with the other components: *interior spaces* or *legal and real estate*. Depending on the Department, School, or College’s curriculum, students may choose to partner with other design and construction majors or with policy and development majors. The LSD post-hoc tests do not indicate for landscape architecture students, as they do for urban planning students, which component provides closer relationships in office.

Students must learn to collaborate to find success in academia and in office (Chiocchio, et al., 2011, Crawford, et al., 2011, Glasser, 2000). Glasser wrote further than the educators must also be open to collaboration with each other, administration, and practitioner offices. Though academics often prepare a semester’s assignments before the course begins, the educator should be sure to assess the cohort’s collective development upon Perry’s Scheme (or other instrument or combination of instruments) before creating team based or multidisciplinary approaches. Though students may be hesitant to partner in the classroom, reflection during and after the

project may aid the learner to rethink and strategize for future partnerships and intellectual development (Schon, 1983)

Each partnership developed in the classroom will aid the mindset to collaborate with other professions. Educators must be sure to assess what disciplinary/professional cultural components do the students share or what might they dispute. How can this conversation and partnership grow the project and the student? Future research may gain insight into the long-term, mindset effects of collaborating in the classroom or during entry-level employment.

## 7 References

(AAC&U) Association of American Colleges and Universities (2009). VALUE Rubrics.

Washington, D.C.

Bauer, H. H. (1990). Barriers against Interdisciplinarity: Implications for Studies of Science,

Technology, and Society (STS). *Science, Technology & Human Values*, 15(1), 105-119.

Berghorn, G. (2014). *Life Cycle Cost-Based Risk Model for Energy Performance Contracting*

*Retrofits*. (Doctor of Philosophy of Planning, Design and Construction), Michigan State University.

Burden, A (speaking). Hustwit, G. (Writer). (2011). *Urbanized*. Swiss Dots Production Company, London.

Bureau of Labor Statistics (accessed 2015). <http://www.bls.gov/>.

Chiocchio, F., Forgues, D., Paradis, D., & Iordanova, I. (2011). Teamwork in Integrated Design

Projects: Understanding the Effects of Trust, Conflict, and Collaboration on Performance. *Project Management Journal*, 42(6), 78-91.

Cohen, A. K., & Schuchter, J. W. (2013). Revitalizing Communities Together: The Shared Values,

- Goals, and Work of Education, Urban Planning, and Public Health. *Journal of Urban Health*, 90(2), 187-196.
- Coleman, C. (2002). *Interior Design Handbook of Professional Practice*. New York: McGraw Hill.
- Dalton, R. (2013). *Discerning priorities for soft skill development of environmental natural resource undergraduate students*. (Master of Environmental Design), Michigan State University.
- Forbes, L. H., & Ahmed, S. M. (2011). *Modern Construction : Lean Project Delivery and Integrated Practices*. Boca Raton: CRC Press.
- Glasser, D. E. (2000). Reflections on Architectural Education. *Journal of Architectural Education*, 53(4), 250-252.
- Hjorth, A., & Wilensky, U. (2014). Redesigning Your City - A Constructionist Environment for Urban Planning Education. *Informatics in Education*, 13(2), 197-208.
- Isaacson, W. (2011). *Steve Jobs*. London: Little, Brown.
- Jurin, R. R., Roush, D., & Danter, J. (2010). *Environmental Communication: Skills and Principles for Natural Resource Managers, Scientists, and Engineers* (2 ed.). Dordrecht, Heidelberg, London, New York: Springer.
- Klein, J. T. (2005). Integrative Learning and Interdisciplinary Studies. *peerReview*, 7, 8-10.
- Lang, S., Crawford, P., Machemer, P., & Sterner, G. (2010). *Assessment of Learning on Student Learning Outcomes in Higher Education Programs*. Poster presented at the American Society for Horticulture Science, Palm Desert, California.
- Olsen, C., & Namara, S. M. (2014). *Collaborations in Architecture and Engineering* (2 ed.). New York City and Oxford: Routledge.



- Perry, W. G. (1981). Cognitive and Ethical Growth: The Making of Meaning. In A. W. C. a. Associates (Ed.), *The Modern American College: Responding to New Realities of Diverse Students and a Changing Society*. San Francisco: Jossey-Bass, Inc.
- Pfammatter, U. (2000). *The Making of the Modern Architect and Engineer*. Basel: Birhauser.
- Ravitch, D. (2007). *EdSpeak: A Glossary of Education Terms, Phrases, Buzzwords, and Jargon*. Alexandria: Association for Supervision and Curriculum Development.
- Schon, D. (1983). *Reflective Practitioner : How Professionals Think in Action*. New York: Basic Books.
- Shah, T., & Mulla, Z. R. (2013). Leader Motives, Impression Management, and Charisma : A Comparison of Steve Jobs and Bill Gates. *Management and Labour Studies*, 38(3), 155-184.
- Stember, M. (1991). Advancing the social sciences through interdisciplinary enterprise. *The Social Science Journal*, 28(1), 1-14.
- Sweet, E. L., & Etienne, H. F. (2011). Commentary: Diversity in Urban Planning Education and Practice. *Journal of Planning Education and Research*, 31(3), 332-339.
- Tuckman, B. W., & Jensen, M. A. C. (1977). Stages of Small Group Development Revisted. *Group and Organization Management*, 2(4), 419-427.
- Webb, P. (2010). Medium to Long-Run Implications of High Food Prices for Global Nutrition. *The Journal of Nutrition*, 140(1), 143s-147s.
- Wilson, S., & Zamberlan, L. (2012). Show Me Yours: Developing a Faculty-Wide Interdisciplinary Initiative in Built Environment Higher Education. *Contemporary Issues in Education Research*, 5(4), 331-342.

Wood, G. (1999). Interdisciplinary working in built environment education. *Education and Training*, 41(8/9), 373-380.

## **BIO**

### **Robert Dalton**

Robert Dalton is a PhD candidate in Michigan State University's integrated School of Planning, Design and Construction. He teaches a multidisciplinary, digital graphics course and is the project coordinator for the World Class Built Environment Initiative. His research spans the broad field of collaborative urban design, including the creation of multidisciplinary teams, community engagement, and key stakeholder education. Rob serves on the Initiative's design committee to create urban corridors for the 21<sup>st</sup> century and beyond.

### **Pat Crawford**

Dr. Pat Crawford, is the Associate Director of the School of Planning, Design and Construction and an MSU Associate Professor of Landscape Architecture at Michigan State University. Dr. Crawford is a licensed Landscape Architect and has nine years practice experience with the Missouri Division of State Parks. Her interests include landscape site design, master planning, and community engagement. Through the scholarship of teaching and learning Dr. Crawford pursues studies in integrative learning, active learning, study abroad, and curriculum development of professional planning and design education and soft skill (employability) development. She is a member of MSU's Lilly Teaching Fellows.

### **Christina DeJong**

Christina DeJong is an associate professor in the School of Criminal Justice at Michigan State University and former Director in the Center for Integrative Studies in Social Science. Her research interests focus on violence against women, hate crimes based on sexual orientation and gender identity, genocidal violence, and gender differences in policing

# **AN URBAN RIVER PARK VITALIZING NEW CITY DEVELOPMENT: APPLYING “SHAN-SHUI CITY” CONCEPT INTO THE LANDSCAPE PLANNING AND DESIGN OF YULONG PARK IN THE NEW CITY OF FUXIN, CHINA**

**HU, JIE**

Vice-president, Beijing Tsinghua Tongheng Urban Planning & Design Institute, and Director of Research Center for Landscape Architecture in THUPDI

## **ABSTRACT**

*Urbanization has brought many advantages to human beings, but it also brought a series of ecological environmental problems at the same time, such as deterioration of natural ecological system, fragmentation of habitats and environmental pollution, etc. Studies on river ecological systems cannot be isolated from their evolutionary context. Almost a century's worth of global economic development, population increase, environmental pollution and urbanization have greatly changed the characteristics of original rivers. Statistic shows about 60% of rivers in the world have been artificially modified, including dam and embankment constructions as well as river reformations (Brookes & Shields 2001). In China, most rivers have more or less been developed or utilized, except for a few big rivers in the remote areas of southwestern and northeastern China. Inspired by traditional Chinese Shan-shui City concept, the objective of the project is to find applicable approaches for most cities in China that are undergoing rapid urbanization with modified river context; from a practical perspective the current challenges include dealing with artificial canalization and insufficient water discharge due to improper water usage. Yulong Park is a pilot project for Fuxin City providing a good opportunity in urban spatial development, while meeting different demands from local residents, building upon the traditional urban context and enhancing urban functions. It has directly improved quality of life in Fuxin city, increasing the happiness index of local residents and playing a profound role in the sustainable development of the new city.*

## **1.1 Keywords**

Urban River Park; Shan-shui City; New City Vitalization

## **2 URBAN RIVER PROBLEMS IN NORTHERN CHINESE CITIES**

Under the increasingly rapid urbanization process in China, urban rivers have not only been restricted through flood control functions, which are carried out through artificial constructions

such as dams and hard embankments, but rather in the tendency to realize multi-functional development. Landscape planning and design of urban rivers will provide more benefits for urban development under the new type of urbanization in China. However, almost a century's worth of accelerated global economic development has resulted in many urban problems, especially in northern Chinese cities, which face big challenges from both human and natural aspects, such as:

- A. Growing population and lessening construction land, which have caused high density urban development and resulted in squeezed riverways;
- B. Lower total precipitation resulting in drought for the urban ecological environment, and more frequent rainstorms resulting in severe flood disasters;
- C. Lowered efficiency in water usage – improper agriculture, industrial and urban water usage resulting in drought discharges for riverways;
- D. Green space planning was not a high priority for early urban development, which resulted in fragmentized urban green space that is not easily adjusted for improving the ecological environment;
- E. Landscape architects and urban designers had reduced roles in planning and designing urban riverfronts, because the hydrological department had control over the design, which resulted in poor urban and landscape design in waterfront areas.

### **3 AN URBAN RIVER PARK VITALIZING NEW CITY DEVELOPMENT**

#### **3.1 Project Background**

Yulong Park is located in the new city of Fuxin, and is the first phase of Jiuyingzi River Landscape Construction project, in a 64.8ha designated area. Located in the north-west of Liaoning Province, Fuxin City is an important component of Shenyang's Economic Zone. It is a city in an

area with more than 7600 years of history. A famous Chinese archeologist Mr. Su Bing-qi regards Fuxin City as the “hometown of the jade dragon, and origin of civilization”. A stacked sculpture in dragon-shape and made with red stone, was an excavated artifact from the original Chahai Village in Fuxin, which is part of the “Pre-Hongshan” cultural heritage from over 8000 years ago. Additionally, Fuxin is the processing center and source market for agate products in China, and it is also well-known for wind and hydraulic power generation, and the largest fluorite and silica sand storage in China.

However, because of long-term coal mining excavation, the city was claimed by the national government in 2001 as the first resource-exhausted city and was then urged to carry out economic transformation. The construction of Yulong New City is the main component of the strategic plan in driving industrial conversion and regional development. As the landscape core of the new city, Yulong Park is taking on the task of seamlessly blending together the old and new city, and incorporating local culture and long-standing history, as well as creating a meaningful place for human activities and natural landscapes in order to vitalize the new urban area of the city, which with a population of 1.8 million until 2010.

### **3.2 Existing ecological problems of the urban river**

The new city of Fuxin has been planned to be built at the north of the old city, crossing Jiuyingzi River, which is an important branch of the Xi River. The total length of Jiuyingzi River is 19km, and in the watershed area is about 153.5km (Xiao, Li-ping., et al.2008). There is an existing small reservoir at the upper reaches of the river and the length of the river within the urban area is 7.95km, and it has a slope of 0.5%. The general ecological problems of the river can be summarized as follows:

#### A. Threats of flood disaster

Jiuyingzi River shows typical characteristics of mountainous riverways with high instantaneous peak discharge and mudslides. As the slope of the riverway is comparatively steep (0.5%), the water is fast flowing, which means more erosion and other potential threats. It can be seen from the existing site photos that most of the area was covered by therophyte and the vegetation coverage of the watershed was less than 30%, which has increased the rate of soil erosion to 32,600 tons of sediment annually causing the river bed to rise. Meanwhile, because of the fast urban expansion, dense construction has left narrow canalized riverways about 50-70m wide on average, which seriously reduced the flood section leading to frequent flooding.

#### B. Drought of river discharge

The main water source of Jiuyingzi River comes from rainfall, forming surface runoff and subsurface water and then supplying the rivers. Since the local climate is comparatively dry – multi-year average annual precipitation is less than 500mm - compared to that of 628mm in China and 834mm in the world, in addition to low efficiency water usage - approximately 70% for agriculture and 25% for industry and only 5-10% for ecological use, the amount of water discharged to the river has been deteriorated, leading to only a baseflow in the river for most of the year. However, the 2.0L/s.m baseflow in the riverway can still be used as a water resource for the landscape development.

#### C. Poor forest protection

Existing forest protection was around the riverway in a comparatively large area. However, it is hard to meet requirements of flood protection and embankment functions, due to the

fragmented distribution of forests and single plant species. The forest has undeveloped shrub layer and had poor habitats and biodiversity.

### **3.3 Planning Concepts and Objectives**

#### **3.3.1 Planning Concepts**

Shan-Shui City was first defined by Mr. QianXue-sen as “a concept, which integrates Chinese Shan-Shui poetry, Chinese classical garden design and Chinese Shan-Shui painting” (Bao, Shi-xing&GuMeng-chao 2009). The Shan-Shui City in his imagination is somewhere that “integrates classical Chinese garden design with city planning and the natural landscape to allow all citizens the chance to live in a ‘garden’ (Bao, Shi-xing&GuMeng-chao 1999). Since then the discussion and application of Shan-Shui City theory of urban construction practices has been scientifically tested.

First based on our practices, a positive ecological environment is the fundamental basis for a “Shan-Shui City”, in which Chinese characteristics of mountains and water, Shan-Shui culture, natural landscapes, and the city are integrated together to form a picturesque city like a three-dimensional Shan-Shui painting. Second, a Shan-Shui City serves for all people and not only for a few individuals in their private “Shan-Shui mansions”. Third, to construct a Shan-Shui City that brings physical and spiritual happiness to the citizens relies on modern science and technology, and environmental aesthetics.

#### **3.3.2 Planning Objectives**

Given the prerequisite of combining mountain-water factors and dragon cultural imageries at a regional scale, natural mountain-water structures and abstracted urban Shan-shui (Mountain-

Water) cultures have been considered to create an urban landscape with local Shan-shui characteristics.

The main objective for the landscape designers and engineers was to create an ecological healthy and livable riverfront landscape for the new city of Fuxin. Fuxin is undergoing economic transition from the leading mining industry to modern agricultural and modern service industries. The construction of the new city is exemplary for the sustainable development that China is undergoing. The long term planning goal for Fuxin is to solve the existing problems such as inefficiency water usage and improper flooding control constructions, which occur in regional scale, thus creating a balanced situation between the urban and the rural and between human and nature. The landscape plan was firstly to revitalize the ecological system of Jiuyingzi river, connecting the old and new city by the ecological corridor that leading to the adjacent mountainous forest, while providing an urban river park that plays cultural, recreational and ecological functions. Secondly, Yulong Park as the core area of the new city and the river restoration project, is a flood storage reservoir, a micro climate adjuster, a dynamic urban park, and also the landmark and the cultural center of the new city.

### **3.4 Landscape Planning and Design of Fuxin Yulong Park**

#### **3.4.1 Regional landscape structure and river corridor functions**

In the Shan-shui structure of the new city, an ecological axis formed by the large river corridor of Jiuyingzi River connects the old and new city of Fuxin and Yulong Mountain, making the final landscape axis blend into the natural mountain forest environment. Meanwhile, establishing an urban development link from the old city to the new city expresses the important administrative



business function of the new city by creating an economic functional axis composed of the new core area, Yulong Lake and Jiefang Avenue (the main street).

### **3.4.2 Functional zoning plan of the river corridor**

The river length between the new city boundary and the existing reservoir is about 10km, which functions as flood adjustment and water supply in dry seasons. The next 3km of the river is within the village areas and is mainly for providing agricultural irrigation and absorbing farmland runoff. Within the new city's administrative scope, the existing riverway of 50-70m wide has been widened into 300m across in order to reduce the flooding threats. After a 2km long straightaway, an artificial wetland has been created at a water confluence area which collects water from the Han River that originates from Yulong Mountain with flood drainage from the old city and grey water drainage from a water treatment plant from the old city, in order to intercept sediments and purify water resources. Then the river flows into the central area of the new city, which will be designed holistically with the surrounding public buildings, forming the landmark area for the new city. Finally, the river flows to the southwest to meet with the planned green field that will operate as an open flood storage river park. Thus, the existing mature forests between Yulong Mountain and Jiuyingzi River have been connected with the old city through a restored green river corridor to enhance the ecological connection between the old and new city.

### 3.4.3 Landscape design strategies of Yulong Park (Figure 1)

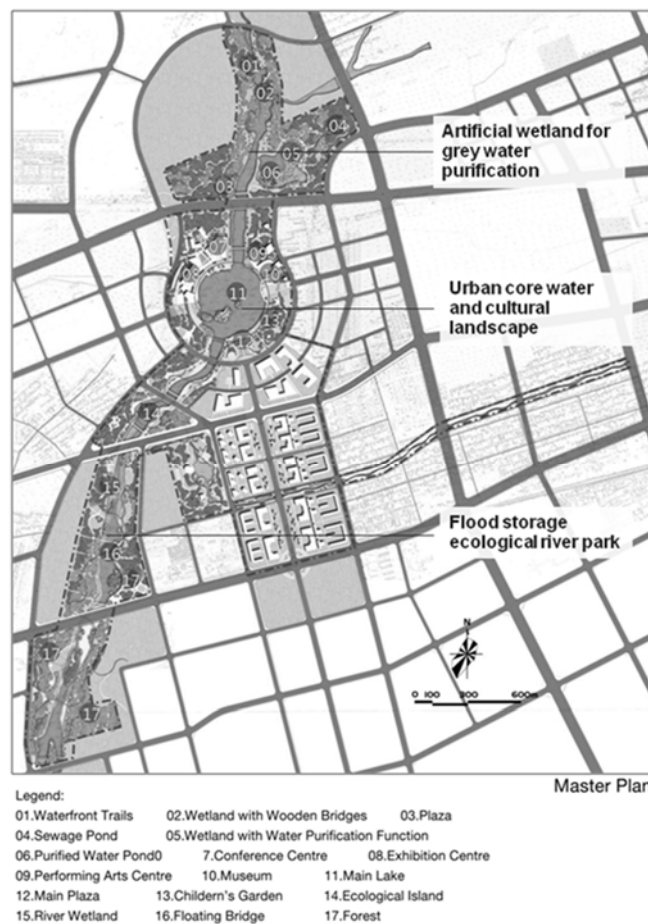


Figure 1 Master plan of Yulong Park

#### A. Transform the riverscape into an urban waterfront

Jiuyingzi River and Yulong Mountain form the landscape basis for new city development in Fuxin. To remit the flooding threats and the scarcity of water resources, flexible flap gates have been used to collect the stormwater and baseflow for a broader area of water body which functions as flooding storage urban reservoir at the center of the new city. The water body also contributes to micro climate adjustment. The flap gates lengthwise of the river create a cascade with various water levels thus generating ecologically and spatially distinct habitats and spheres. In times of

high discharges the flap gates can be lowered to make sure the natural river regime can follow its course; and in dry period, the gates will be opened to accept water from the reservoir at the upper reach, which will bring fish and water organisms to the landscape water body. When the ecological restoration of Jiuyingzi River is completed, these processes will occur annually. This flexibility has been taken into account in the design of the flap gates.

#### B. Connect the riverscape with the urban field

The landscape planning and design objective is to make the renewed river landscape axis blend gradually into the natural mountainous forest environment and connecting the landscape axis with the urban axis from the old city to the new city, thus creating a unique Shan-shui city (Mountain-Water-City) for the future of Fuxin City. Existing trees, green structures, park elements and infrastructure are used to establish an attractive, ecological and recreational connection between the river scape and the old city. Therefore, an urban-landscape axis has been formed in the city's main street to connect the renewed landscape node in the Jiuyingzi River with the central square of old Fuxin City. An existing monumental, the new created green axis relates mainly to the administrative business district thus expressing the important economic function of Fuxin city. The familiarity of the two connected nodes is expressed by using the same circular form in the landscape design and lighting of the water pond as the existing roundabout in the city square.

#### C. Use of local history to create a cultural hotspot

The transformation of the riverscape of Jiuyingzi River was taken as an opportunity to create a cultural hotspot in the river landscape node, and it consists of a museum, theatre and cultural center with complementary open-air facilities. The jade dragon cultural heritage serves as inspiration to design the various features in the hotspot. In the design this aspect is recognized

through a dragon-shaped infrastructure system for bicyclists, battery cars and pedestrians, connecting with parking lots and docks, which stimulate a low carbon lifestyle in the new city. The 7m wide and 7300 meter dragon-shaped route performs as the main path of the park and as a long flood bank, forming a barrier for 50 year floods.

Secondly, the architecture is shaped in jade form. The relationship between buildings and natural surroundings is considered through respecting the natural skyline and creating a viewing corridor forward the remote mountain scenery. All correspond to the layout of natural mountain-water, which expresses the Shan-shui concept in reality.

#### D. Facilitate social use and cultural activities in open space

The landscape design considered the characteristics and demands of nearby residents, creating different activity spaces for children, the elderly and various group activities. Open and shaded spaces are designed in relation with the existing vegetation and the embankments of the cascaded river. Around the central water pond cultural plazas are designed for the considered multiple functions, such as commerce, leisure, recreation and fitness. Evergreen trees, aquatic plants, fall-color-plants and spring-blooming plants are combined along the river to provide layered vegetation and interesting landscape throughout the year (Figure 21). The upscaled central plaza connects the central water pond with the urban-landscape axis to the center of Fuxin, and expresses the need for social gatherings like dancing and singing in large groups.

## 4 OUTCOMES

The landscape design of Yulong Park transformed the deteriorated Jiuyingzi River into a spatial, ecological and cultural hotspot in the city of Fuxin. The widened and restored river system reduced the threats from flood disasters. Local history, landscape, city development and

architecture blend together on the edges of the old and new city, thus creating a meaningful place for human activities, nature and landscape features that reflects the future identity of the city of Fuxin. The frequent use of the park by large numbers of people, independently of weather conditions, express the appreciation of this new urban landscape (Figure 2).



Figure 2 Before and after photos of the site

The park has become the green urban living room for the new city of Fuxin. Large cultural and social events are held here. People gather here or come for daily recreational activities, such as jogging, boating, riding bicycles and so on. The park provides Fuxin an urban refuge for the high density residence, while having promoted urban economic prosperity. It has symbolized the urban revolution, became the catalyst for urban prosperity, and added greater value than was expected at its conception. Following the completion of the park, the housing prices of the adjacent

communities have risen from 2,000 to 8,500 RMB per m<sup>2</sup>. The land value surrounding this area has increased by at least 50 billion RMB. Local and foreign merchants face heavy competition to gain entry into the nearby commercial district; 31 contracts have been signed and the total investment is up to 39 billion RMB.

## **5 CONCLUSIONS**

After more than 20 years rapid urbanization, China is now entering a phase of new-type urbanization that focuses on sustainable urban and rural development. Fuxin as an early industrial city in northeast China has the typical urban development relics – squeezed river corridors, fragmented green fields and less sophisticated urban planning. The landscape planning and design of Yulong Park in the core area of the new city transforms the previous poor riverscape into a dynamic urban waterfront. It carries higher flood capacity while providing necessities for urban use in terms of ecological, economic and cultural aspects. As a pilot project for Fuxin City, it provides an opportunity for urban spatial development, which gathering multi-functions in one area, thereby playing a profound role in the sustainable development of urbanization. It is a milestone in China's new-type urbanization process, which contributes a healthy lifestyle and advanced consciousness.

## **6 REFERENCE**

1. Brookes A. Shields F D. *River channel restoration: guiding principles for sustainable projects* [M]. John Wiley & Sons, Chichester, England, 2001.
2. Xiao, Li-ping & Chu, Yu-fang & Liang, Bing. Sustainable of water resources and sustainable stylizing strategies in Fuxin city [J]. *Journal of water resources and water engineering*. 2008(02):22-27.

3. Bao, Shi-xing&GuMeng-chao. *A Probe into QianXuesen's Thoughts on Architectural Science* [M]. Beijing: China Architecture and Building Press, 2009: 47.
4. Bao, Shi-xing&GuMeng-chao. *Shan-shui city and science of architecture* [M]. Beijing: China Architecture and Building Press, 1999: 43.
5. Fang, Chuang-lin at al. Report of Chinese new-type of urbanization [R]. Beijing: Science Press, 2014.
6. Hydrology department of China. 2013 Report of water resources in China [R]. Beijing: China Water Power Press, 2013.

## 2 ILLUSTRATIONS

1. Master plan of Yulong Park
2. Before and after photos of the site

### BIO

Jie Hu, FASLA, is Vice-president of Beijing Tsinghua Tongheng Urban Planning & Design Institute (THUPDI), Director of Research Center for Landscape Architecture in THUPDI, Council Member of Chinese Society of Landscape Architecture. He holds Master of Landscape Architecture from University of Illinois and Beijing Forestry University. He has over 20 year's practical experiences both in the U.S. and China, and used to give lectures in international meetings and institutions with topics related to sustainable design. His current research focuses on the application of Shan-shui City concept in multi-scale landscape practices.





**DILEMMA: DEBATE**

UtahStateUniversity CELA 2016